MODEL AIRPLANE NEWS

SCALE RIVET TECHNIQUES

THE WORLD'S PREMIER R/C MODELING MAGAZINE

48120 August 1996

Top Gun SCALE INVITATIONAL

— see page 66

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MODEL AIRPLANE NEWS

AUGUST 1996 • VOLUME 124, NUMBER 8

columns

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ON THE COVER: *main photo—Jim Sandquist's practice model—an Aerotech P-51D Mustang—comes in for a landing at the '96 Top Gun Scale Invitational. (Photo by Walter Sidas.) Insets all from Top Gun (clockwise from top): Garland Hamilton shows off his stunning BVM DT-33 Sea Star; Terry Nitsch's Minute Men F-86 Sabre Jet; Nick Ziroli's P-38 Lightning; Graeme Mears and Dave Patrick with Graeme's DH 82A Tiger Moth; Bob Underwood's Hiperbipe homebuilt.*

ON THIS PAGE: *the classic Kwik FLy 40 in ARF form is a great performer. (Photo by Walter Sidas.)*

AIRWAVES

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," **Model Airplane News,** 251 Danbury Road, Wilton, CT 06897-3035; e-mail: man@airage.com. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we can not respond to every one.

NOVICE APPRECIATION

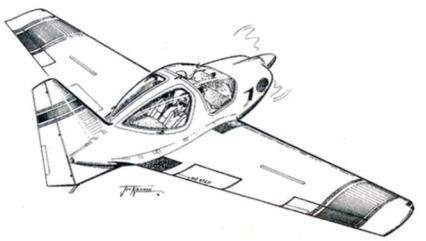
I'm a newcomer to model aviation, and I just wanted to express my opinion of the people with whom I have come in contact. So far, without exception, everyone has been helpful and encouraging. I found a great little hobby shop here—New Creations R/C—and owner Kirk Massey invited me to go flying with him and a friend. This friend, Dave Baron, should be familiar to you because he is a *Model Airplane News* contributing editor.

Dave spent a lot of time flying with me. He is a great "people person" as well as an awesome pilot. He test-flew my Bill Evans Zipity-Do-Dah, trimmed it out and put it into my hands. Before the day was over, he had me make my first solo flight.

My thanks to Kirk and Dave and to all the people I've met in this exciting sport!

DICK PURSLEY
Willis, TX

Thanks for sharing your introduction to model airplanes with us, Dick. As I can attest, Dave Baron is a wonderfully patient flight instructor and an expert pilot and builder. I'm sure that the rest of your R/C experiences will be just as memorable. Happy flying! DS



PROTOTYPE SCALE

Rupert Kosmala's article, "Pseudo Scale," with Jim Newman's illustrations (May 1996 issue) made a superbly professional presentation of a proposal that deserves serious consideration.

A few years ago, Steve Rojecki flew a scale Reed Falcon Biplane to first place at the Tournament of Champions. Steve, a jet fighter pilot, obviously beat the bushes to flush out the obscure Australian design that he thought would be best for the job. I wonder whether even one spectator at his magnificent flying display had ever heard of a Reed Falcon—or cared whether a full-size example existed. Steve was obliged by the rules to copy an existing design, along with all of its known shortcomings and compromises. Suppose he had a clean slate. Would he have flown even better? We will never know. Why not give top-caliber modelers the option of designing and building the best airplane for the job—a model with the potential to be transformed into a full-scale aerobatic machine once it has proven its mettle in top-level competition?

There are extremely capable airplane designers among us who might well produce a world-champion full-scale aerobatic design. A could-be-scale model that consistently outflew the best models of the Laser, Extra, Ultimate, etc. (no small feat!), would attract the attention of full-scale aerobatic designers/builders.

To call such an airplane a "model" is clearly wrong. It would be more accurate to call the follow-on, man-carrying version a "model"—an enlarged replica of an outstanding, smaller, unmanned aircraft. Minimal modification should be needed to transform a competently designed "model" to full scale, provided that its proportions would accommodate a suitable engine and a human pilot. For one, R/C'ers might lead, rather than follow, the full-scale people and win well-deserved recognition. Otherwise, the public may continue to regard even our highest-level activity as something of an aviation backwater and think of us as dedicated to building and flying cute little copies of "real" airplanes.

It's time to break our self-imposed shackles. Phil Kraft, a former world model aerobatic champion, innovator and manufacturer of top-echelon R/C gear, designed and built his full-size Supra-Fly competition aerobatic airplane as a model. He tested the design's mettle, particularly in some of the scarier corners of the performance envelope, before he committed himself to the full-scale version. Over the years, various airplanes that became successful full-size machines were flight-tested and fine-tuned as scale models. Some even carried (undoubtedly somewhat concerned) human pilots decades before suitable R/C equipment became available.

"Prototype scale," or "proto scale," gets my vote for this proposed competitive category. "Pseudo scale," I think, smacks of phoniness. Now, to suggestions for the rules. Proto scale should initially fit best in aerobatic competition. That's where my suggestions are aimed, although it could be expanded to embrace, and possibly influence, much of the light-aircraft world.

1. Your airplane shall be a reduced-scale prototype of a proposed human-piloted aircraft. You shall present scale 3-views that need only be sufficiently detailed to demonstrate that an enlarged version would be feasible with minimal modification.

2. Your design must accommodate your proposed full-scale engine, cooling system and accessories. Your reduced-scale prototype's cockpit must comfortably seat a scaled-down, full-figure pilot and provide an adequate field of vision. A disembodied head and shoulders glued to a flap sheet of plywood won't cut it. (My full-figure pilots suggestion needn't be mandatory. I just happen to like them, particularly if the cockpit is open.) Your prototype's panel need not be super-detailed, but the pilot's office must look habitable and functional.

3. The overall dimensions of the proposed piloted aircraft must fall within reasonable bounds for its intended purpose.

4. Static judging shall earn only penalty points, which will be subtracted from your flying score. The best static score you can hope for is zero. You can "cheat" to your larcenous heart's content by, for example, specifying some conveniently compact miracle engine and providing sardine-can pilot living space. Just be prepared to demonstrate the superhuman flying acumen you will need to offset your static demerits. Forget about slipping a pilot seat into your favorite pattern model and trying to pass it off as an airplane that just happens to need enlargement to a 50-foot wingspan to squeeze in all but severely stunted pilots.

5. Modified (or even entirely stock) scale versions of existing manned airplanes will be acceptable. Top performance is the goal; your job is to get it. The aim is to permit prototype scale aircraft, as far as possible, to compete harmoniously in existing events. Full-scale designers are not dummies. Many proto scale entries will fail to outperform scale models of the best manned aircraft. Some will excel. That's your challenge. Are you up to it? What do you think?

CARL RISTEEN
Fredericton, N.B., Canada

EDITORIAL

by GERRY YARRISH

TOP GUN AND TOLEDO!

We're proud to present our 1996 Top Gun Scale Invitational coverage from sunny West Palm Beach, FL. With more than 60 contestants from across the U.S., Germany, Canada and Brazil, this year should go down in the record books as one of the most exciting yet. Many familiar faces were at Top Gun, along with a crop of new models, including twins and three turbine-powered jets. With perfect weather, expert flying and absolutely the most gorgeous scale model airplanes ever built, it was a stellar event. Who won the 1996 Top Gun shootout? Check out our coverage to find out!

At the '96 Top Gun Scale Invitational, Garland Hamilton's beautiful DT-33B Sea Star does a slow and dirty flyby—flaps and gear down. Built from a BVM kit and powered by a JPX T-260 turbine, it was one of three turbine-powered models in the competition. Garland took seventh place in Expert and the Best Jet award.

Also in this issue, we've expanded our "Scoop" with coverage of the innovative products that showed up at the Toledo hobby trade show, held at the SeaGate Convention Center in downtown Toledo, OH. From engines and onboard chargers to precision control linkages and radios, we have the lowdown on this year's hottest hobby products. If you didn't get to Toledo, you can't afford to miss this.

MODELING AT NASA

Many of today's famous aircraft were developed using scale models. But one unrecognized model that has been very important to NASA's aircraft design and testing programs is the Mothership. Still in use today, the Mothership has been used for almost three decades to carry and then drop test models. It was extensively used to test a variety of aircraft designs in the lifting-body aircraft series that led to the development of the space shuttle, and it has undergone many changes and modifications. Author Dave Eichstedt has been involved with NASA and the Mothership for many years, and he delivers some fascinating information on the low-tech approach that NASA successfully used to develop some incredibly high-tech aircraft. Check out this historical overview of NASA's unsung workhorse—the Mothership.

RIVETING SUBJECT

"Scale Techniques" columnist George Leu brings us some up-close-and-personal information on one of the most popular scale detailing techniques—duplicating raised-head rivets. More than just adding bumps to a model's surface, rivet detail can transform a great-looking scale model into an accurate miniature of a full-size aircraft. But as with any technique, you need lots of practice and patience to properly execute it. George's explanation, along with Jim Newman's superb illustrations, will make it easier for you to get started and, more important, to be successful. Give rivets a try, and you'll soon think your models are incomplete without them.

ARE BRUSHLESS MOTORS FOR YOU?

Contributor Bernard Cawley Jr. brings us his findings on today's popular brushless motors and lets us know what's up in this new, high end of electric-motor development. Bernard tested the brushless motors and he compares his findings with those obtained using the standard brushed motors that electric-power modelers use regularly. So if you've been contemplating the move to brushless motors, but you want more information, check out Bernard's article; what you find might surprise you.

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INTERNET *man@airage.com*

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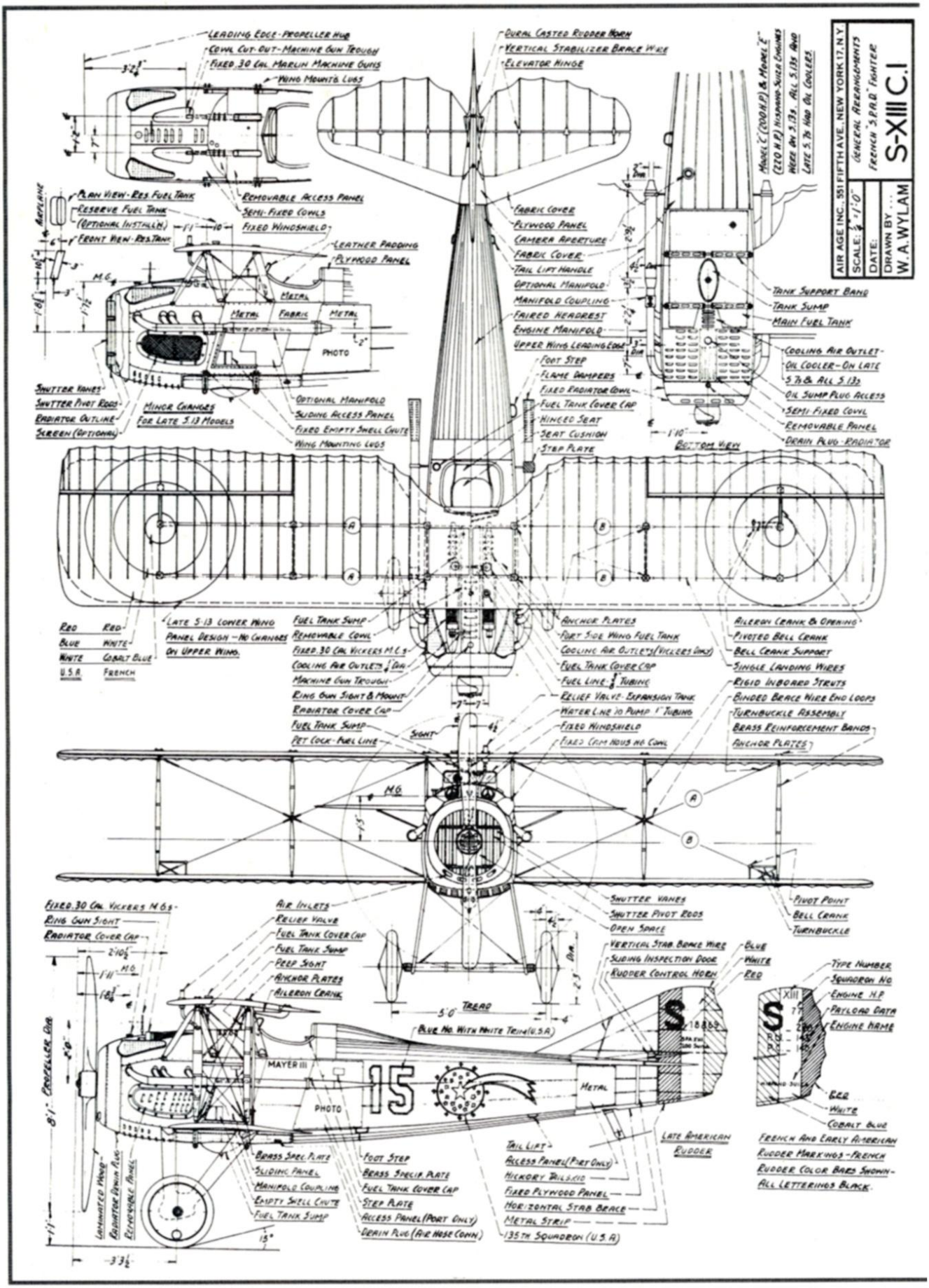
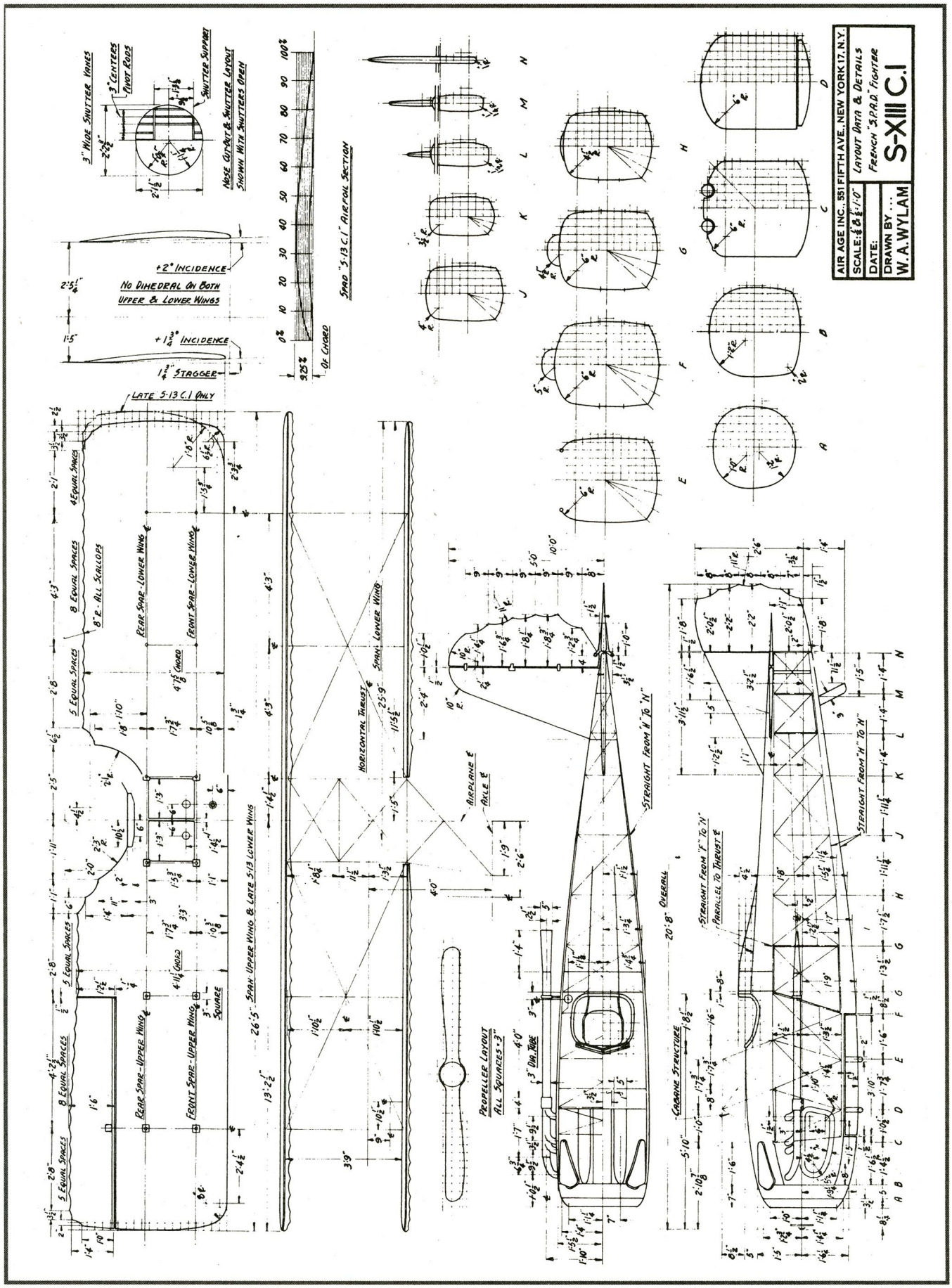
Planes Worth Modeling

Spad S-XIII C.1

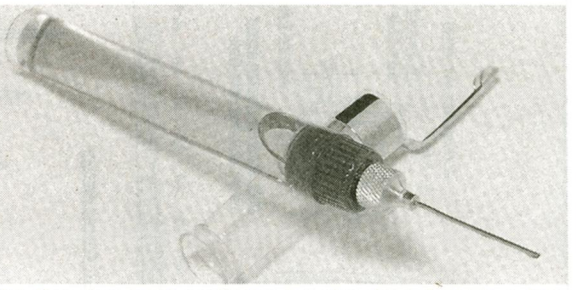


3-View Documentation for Scale Modelers



by GEORGE LEU

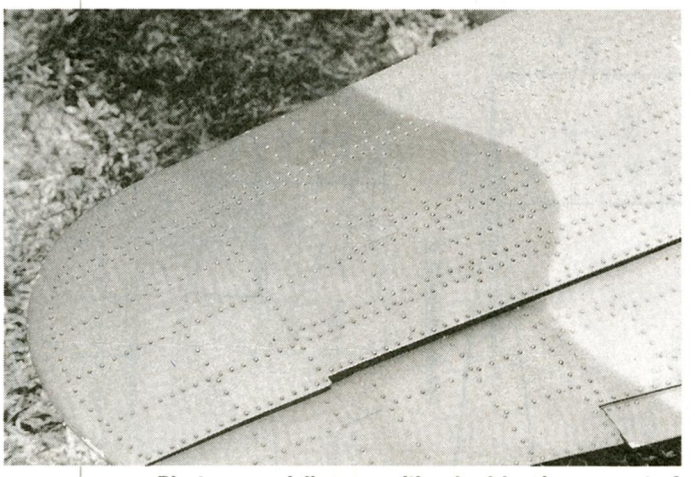
APPLY RIVET DETAIL TO YOUR NEXT MODEL



Another very good applicator for glue-drop rivets is a fine-tipped pocket oiler such as this one (available from the R/C car department at your local hobby shop). Just clean out all the oil before you fill it with your water/glue mixture.

Applying scale rivets to your model airplane requires understanding and experimentation to achieve satisfying results. The technique you use to reproduce them will vary depending on your skill level and the level of detailing you're comfortable with.

When stand-off-scale judging was restricted to a 15-foot distance, scale modelers finished their aircraft to show details that could easily be seen from that distance, e.g., larger-than-scale rivets and panel lines. Rivets reproduced on a 1/6-scale model would probably have been the size of half a grapefruit on the full-size aircraft. The intention was to make it easy for judges to see rivet detail.



Rivets—especially ones with raised heads—are part of almost every scale model you might want to build. Once you learn the technique, adding them to your model is easy.

Today, almost all scale model competitions allow static judging to be done within 1 to 4 feet for the purpose of observing craftsmanship and details. There's no longer a need for modelers to exaggerate rivet size. Of course, this also means that judges can now see whether the proper type of rivet has been reproduced, be it a flush, braiser-head or pop-rivet. Let's take a closer look at rivets and application techniques.

RAISED RIVETS

To obtain the appearance of standard, run-of-the-mill raised or braiser-head rivets, I like to use a mixture of white glue and water. Any white glue will yield satisfactory results, but I prefer to use Formula 560 from Pacer Technology*. When mixed approximately half and half with water, this glue produces rivets that won't shrink or show concavity when they've dried. I can't say this for other glues I've used.

Depending on how much water you mix with the glue, you can produce larger or smaller rivets. A thick mixture will produce a large, tall, rather obvious rivet head, and a thinner mixture will produce a much less obvious, smaller rivet head. Rivet size is generally dictated by the scale of your model, and it's up to the modeler's discretion.

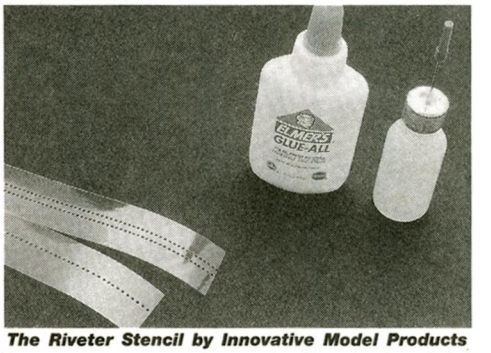
PREPARATION

For best results, apply your rivets after the primer has been sanded smooth and all your panel lines have been applied, but before you paint. Practice makes perfect, so get a piece of butyrate sheet material, and try the following methods on it before you try them on your model.

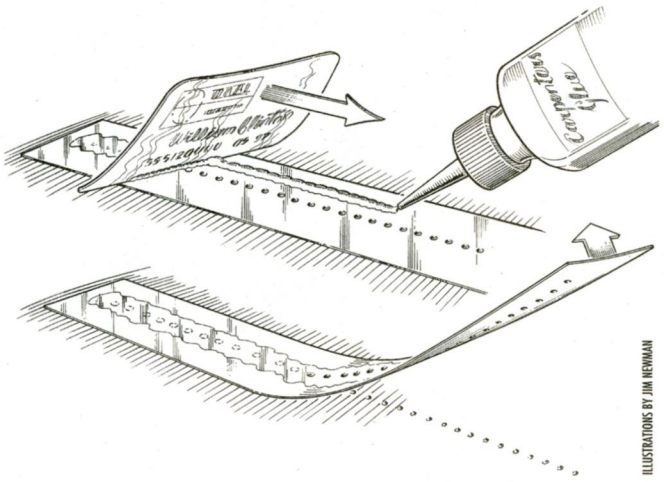
METHODS

There are many ways to apply rivets, so experiment, and develop your own technique. They can be applied using a hypodermic syringe, a toothpick, a common pocket comb or a Riveter Stencil from Innovative Model Products (IMP)*. For each of these methods, you must first draw a reference line with a soft pencil to guide your row of rivets.

• **Hypodermic syringe.** First, cut off the sharp, angled tip of the needle to form a blunt 90-degree end. Use some fine sandpaper to remove any burrs from the tip. Next, fill the syringe with your mixture of glue and water. The trick is to exert just enough pressure (with your thumb on the plunger) to produce only one drop at a time; too much pressure will produce a stream. You want to produce one drop of glue every second or so.



The Riveter Stencil by Innovative Model Products is a new way to apply rows of uniformly placed rivets to your model.



ILLUSTRATIONS BY JIM NEWMAN

The Riveter Stencil is very easy to use. Tape it into place, apply glue over the hole, smear the glue evenly along the strip's length, and then lift the strip for a row of perfectly spaced rivet heads.

Do not touch the tip of the hypo to the model's surface; just allow the glue drop to come in contact with it, and let the model's surface pull the drop away from the end of the needle. Space the rivets about 3/16 inch apart, and try to develop a comfortable rhythm. Don't rush; just concentrate on spacing the drops evenly along the reference line. Move your entire hand in a motion that's parallel to the reference line. The nice thing about using glue for rivet heads is that, if you mess up a rivet head or the spacing, you can simply wipe it away with a damp cloth and do it over.

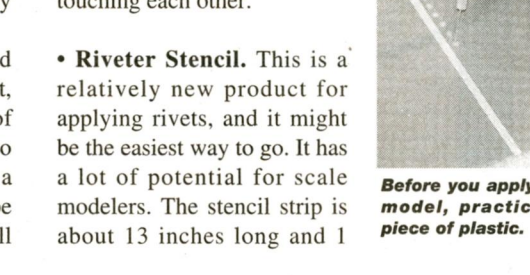
When you've finished, stand back and see how you've done. If you like the result, let it dry, and then apply a light coat of paint. After you've practiced a bit, go on to your model, and work on a section at a time until you've finished. I bet you will be pleasantly surprised at the success you'll have right from the start.

If you can't find a suitable hypodermic syringe, another option is to get a squeeze bottle similar to the one shown in the above drawing of the IMP Riveter Stencil. Fine-tipped oiling tubes are also acceptable for riveting. Just make sure you clean all the oil out of the tube before you fill it with glue.

• **Toothpicks and combs.** Some modelers prefer to apply rivets by dipping the end of a toothpick in glue, applying the rivet, then wiping off the end of the toothpick and repeating the process. As with the hypo method, don't allow the tip of the pick to touch the surface of the model. This method allows you to spread out and shape the rivet a little after it has formed; this works especially well for giant-scale models, but it's more time-consuming than the syringe method.

To speed up the process, some people use pocket combs to apply many rivets at once. A fine-toothed pocket comb is, essentially, a long row of evenly spaced toothpicks. Breaking the comb into small sections and applying six or more rivets at once works better than trying to use the comb at its full length. Dip the comb's teeth into glue, and then gently apply them as mentioned above. Like the toothpicks, the comb should be wiped clean of glue before the next row of rivets can be applied. I find it helpful to break off every other tooth to prevent the glue drops from touching each other.

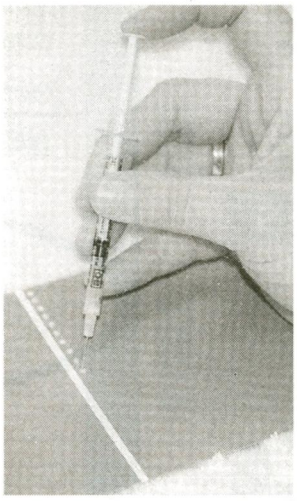
• **Riveter Stencil.** This is a relatively new product for applying rivets, and it might be the easiest way to go. It has a lot of potential for scale modelers. The stencil strip is about 13 inches long and 1 inch wide. It comes with one or two rows of evenly spaced holes punched along its length. The stencil is first placed on the surface and aligned with the reference line. Because the stencil is made of thin, clear plastic, this is very easy to do. Tape the stencil into place, and then apply a thin bead of glue along the row of punched holes. Then, with a small squeegee or a piece of scrap balsa, smear the glue over the row of small holes to fill them, then carefully lift the stencil. What's left is a row of evenly spaced, uniformly sized glue dots. When you apply rows of rivets close to one another, it is best to let the previous row dry before you continue so that the stencil doesn't smear the rivets you've already applied.



Using a hypodermic syringe is the classic way to apply glue-drop rivets. Notice that the needle does not touch the model's surface while the glue is being applied.

I have just started to use this product, but the results look very promising. I find that the size and spacing of the rivets are more suitable for 1/6- or 1/7-scale models, but I have seen the stencil used effectively on a 1/5-scale Spitfire.

A little trick you can use after your rivets have dried is to lightly run 360-grit sandpaper over their heads to take off a bit of the hard edge. Sometimes, I'll mix a little color into the glue mixture so that the rivets will have a worn look when I sand over them during the weathering process. Again, practice and experimentation are the keys to developing a method that best suits your tastes.



Before you apply rivets to your model, practice on a scrap piece of plastic.

All these methods will yield excellent results, but remember that each takes time and practice. When you've become comfortable with one of them, or when you've developed your own method, your model will be elevated to a new level of scale accuracy. Instead of being just a nice, scale model, it will be a true miniature aircraft. Details make the difference.

You should note that more than one kind of rivet is used in aircraft construction. For example, on the leading edge of, say, a Spitfire, raised rivets would not be scale, because flush rivets would be used in this area of the wing. Always carefully look at your documentation first. In future columns, we'll look at duplicating flush rivets as well as at reproducing the screw heads that are so abundant on full-size aircraft. See ya!

** Addresses are listed alphabetically in the Index of Manufacturers on page 128.*

AirSCOOP

by CHRIS CHIANELLI

TOLEDO

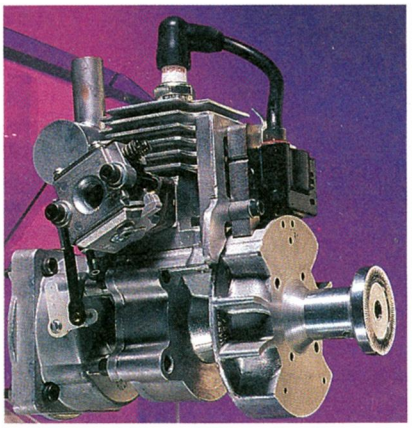
Direct from the Weak Signals Toledo Show (the oldest R/C airplane trade show in the country), here are some new and exciting products that the industry is offering in '96.

Spacewalker ARF

On the heels of Kyosho's very high-quality and reasonably priced J-3 Cub, clipped-wing Cub and Extra comes this 62-inch-wingspan Spacewalker 4C-50 ARF. Like the other kits in the line, the Spacewalker (shown here in the hands of Tim Lampe) is conventionally built up out of balsa and plywood, and like the others, it will be available in an ARF version. The Spacewalker 4C-50 is designed for .48 to .52ci 4-stroke engines or .32 to .40 2-stroke, and should be an extremely docile model to fly.

User-Friendly RADIANT

Always high-spirited, Airtronics president and CEO Bob Renaud is smiling with good reason. The new Radiant 6P/FM (6H heli) could well be the easiest computer radio I've ever operated. Thanks to Radiant's user-friendly menu structure, even the first-time user can begin programming model setups in a matter of minutes. With this radio, you'll spend your time flying, not reading an instruction manual. Features include three-model memory, end-point adjustment and servo-reversing on all channels and sub-trim for fine adjustment of servo centering. Mixing includes aileron>rudder, flap>elevator and throttle>elevator. The moderately priced Radiant has a list of other features too lengthy to go into here. For more information or a free catalogue, contact Airtronics Inc., Dept. 100, 15311 Barranca Pky., Irvine, CA 92718; (714) 727-1474; fax (714) 727-1962.



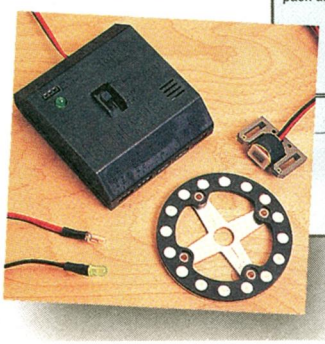
US 25

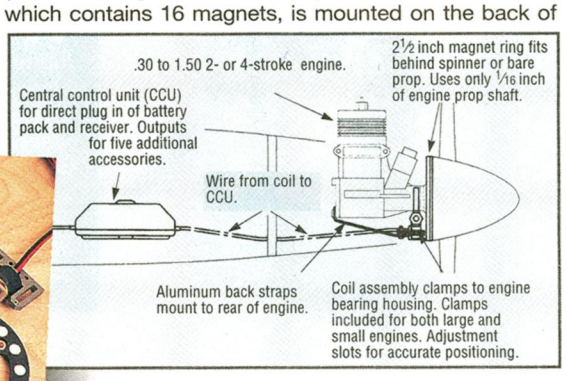
This is US Engines' new 1.5ci (25cc) prototype, soon to be available from Reid's Quality Model Products. Not only is this engine reported to be quite powerful for its displacement (2.0+hp), but all of the necessary components normally available at extra cost, such as throttle linkage, spring starter, model-style muffler and radial mount, come as standard equipment. This engine is truly "firewall-ready." Other features include chrome cylinder, double-counterweight crank with ball bearings, CDI ignition and a one-year limited warranty. The US 25 is available in counter-rotation. Suggested retail price is only $274.95. For more information, contact Reid's Quality Model Products, 16 Main St., Phelps, NY 14532; (315) 548-3779; fax (315) 548-4099.

"Let there be light..."

Genesys

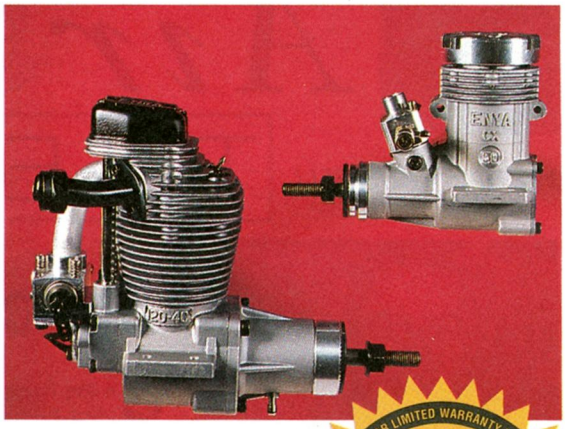
Far and away, I found Sullivan Products' Genesys the most interesting and creative new product at this year's Toledo Show. This unique invention generates electric power when your engine is running. The magnet ring, which contains 16 magnets, is mounted on the back of the prop (or spinner backplate) and rotates adjacent to the coil, which is mounted on the engine front housing. You can use this newfound power to operate Genesys options, such as navigation lights, strobe lights and a rotating beacon. You can also keep your flight-pack batteries fully charged, supply necessary current to run the onboard receiver and servos, recharge a separate battery pack and operate the switch without draining your flight-pack batteries or using a separate battery pack. These options can be combined in any configuration you choose. For more information, contact Sullivan Products, One North Haven St., Baltimore, MD 21224; (410) 732-3500; fax (410) 327-7443.





Futaba's Least Expensive Computer Yet!

I can't tell too much about it now, but here's a look at Futaba's very new computer radio—the 6-channel 6XA FM. I can tell you this much: this very affordable, three-model-memory radio will feature trim memory, two-program mix, air brakes, V-tail, elevon and flaperon. A heli version will be available. Both systems will be available sometime this fall and will be supplied with four S3003 servos. For more information, contact Futaba Corp. (714) 455-9888; fax (714) 455-9899.



One-Year Crash Protection!

5 YEAR LIMITED WARRANTY INCLUDING 1 YEAR CRASH DAMAGE PROTECTION

THIS ENYA ENGINE IS BACKED BY ALTECH'S 5 YEAR LIMITED WARRANTY INCLUDING 1 YEAR CRASH DAMAGE PROTECTION

Altech Marketing, the American importer of Enya engines, announced at the Toledo Show their bold, new *five-year* limited warranty, which includes one-year crash damage protection. It doesn't matter whether you crash your model onto solid concrete from 1,000 feet, suck up half the Sahara in the carburetor venturi or lose a propeller in flight and seize the crank. If you return your registered Enya engine to Altech during the first year of ownership, they will repair or replace it free of any charge for parts, labor or return shipping. That's how confident Altech is about Enya's quality and durability. During years two and three of the warranty, Altech will repair or replace any registered, defective Enya engine with no charge for parts or labor. During years four and five, they will repair or replace any defective Enya parts with no charge for labor. I can relate to Altech's confidence. I've been using Enya engines, both 2- and 4-stroke, since the early '70s, and I can tell you they're reliable and extremely durable, partly because of excellent metallurgy. For more information, contact Altech Marketing, P.O. Box 7182, Edison, NJ 08818-7182; (908) 225-6144.

O.S. 1.40

Meet Great Planes' marketing brands manager, Carol Pesh. Carol is holding the new O.S. 1.40 RX (rear exhaust), designed specifically for F3A pattern competition. The new engine has a fuel pump with a remote needle valve and porting specifically timed for tuned pipes. At this point, that's about all I know, so stay tuned.

Drill-Guide Balance System

With the introduction of Master Airscrew's revolutionary concept in propeller balancing, it's now possible to quickly and easily balance a prop spanwise (tip to tip) and chordwise (across the hub) without sanding or scraping the blades. The patented Drill Guide realigns the mounting hole, in effect, moving the prop's center of gravity. The easy-to-use Drill Guide plates, which are loosely placed over the prop hub, gradually adjust until balance is achieved. (A drill press is required.) The stand adjusts to "over-the-edge" configuration for balancing large props. The system includes balance stand (rod, cones, risers and base), drill guide and a special flat-tip drill. It's available for 3/8- and 5/16-inch motor shafts. Suggested retail price is $39.95. Contact Windsor Propeller Co., 3219 Monier Cir., Rancho Cordova, CA 95742; (916) 631-8385; fax (916) 631-8386.

Backyard Reno Racing

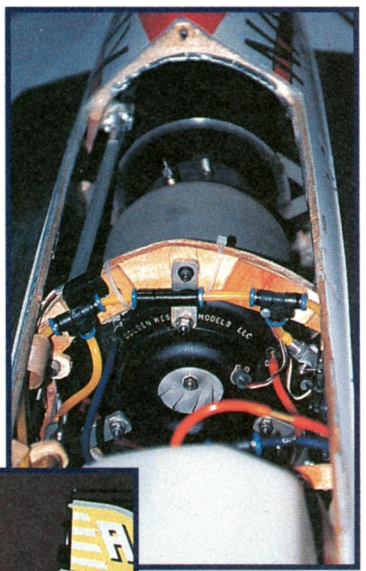
Just think of the fun. All you need are three or four of Ace's new Texans (pictured here with Ace R/C VP of product development Tom Rungee) and two or three poles, and you have the simplicity of ½A racing with the excitement of a Reno race. Like other Ace ½A kits, the Texan uses Ace's time-proven foam wing coupled with a built-up fuselage. Oh yes, if you do get a club race going, paint the Texans in different color schemes. If you don't, I can almost guarantee a spectacular multi-model crash on the second, if not the first, turn! Contact Ace R/C Inc., 116 W. 19th St., P.O. Box 472, Higginsville, MO 64037-0472; (816) 584-7121; fax (816) 584-7761.

Cox Mantis

For the novice ready to advance his flying skills, Cox Products has introduced the ARF Mantis, which was designed around the Cox Tee Dee R/C .05. Shown here with Cox product manager Dave Draper, the 41-inch-wingspan Mantis is constructed of high-quality balsa and can be made ready for flight in just two evenings. (The major components are factory-built and covered.) The 3-channel Mantis includes all the necessary hardware and full-color, fuelproof decals. Contact Cox Products, Inc., 1295 H St., Penrose, CO 81240; (719) 372-6565.

TT F-.54S

With the introduction of this .54, it appears that Thunder Tiger is fully committed to producing a complete 4-stroke line of engines at extremely attractive prices. The currently available .91 has a street price of about $220, and the .54 will cost about $179. Rumor has it that a 1.80 twin is in the works! Contact Thunder Tiger USA, 2430 Lacy Ln., #120, Dallas, TX 75006; (214) 243-8238; fax (214) 243-8255.



New in the Hangar

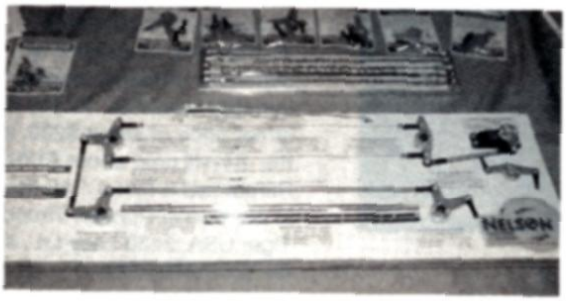
This year's Toledo highlighted two new products from Jet Hangar Hobbies—one beautiful, the other exciting. The pretty ⅛-scale A-4F Skyhawk has a 41-inch wingspan, scale retracts and is designed for a Turbax 1 or any other 5-inch fan unit. Jet Hangar also announced their distribution of the exciting Golden West Models (GWM) FD 3/67 LS turbojet which, according to the manufacturer, is uncomplicated to operate and simple to install. The GWM runs on non-pressurized jet-A fuel (with a mix of 15-percent 100-octane aviation gasoline). The starting procedure calls for a common hair dryer modified for 12 volts DC. Start-up and operation require only a pilot and an assistant. For more information, contact Jet Hangar Hobbies Inc., 10595 Bloomfield, Los Alamitos, CA 90720; (310) 493-1285; fax (310) 493-1765.

Pro Servo Reversing

Have you ever set up an elevator with two servos using a Y-harness, and no matter which way you throw the reversing switch, one of the servos is going in the wrong direction? If you have, the EDR-106 Pro Servo Reverser from Electro Dynamics is the solution. Simply plug your servo into the EDR-106, plug the EDR into the receiver, and you've finished! The accurate, microprocessed neutral needs no adjustment. The fuelproof and vibration-proof, epoxy-encapsulated unit has no jitter and no drift or neutral shift with temperature changes. It's compatible with AM, FM and PCM systems and 4.8V and 6V power sources. The introductory price is $29.95. Contact Electro Dynamics Inc., 31185 Schoolcraft Rd., Livonia, MI 48150; (313) 422-5420; fax (313) 422-5338.

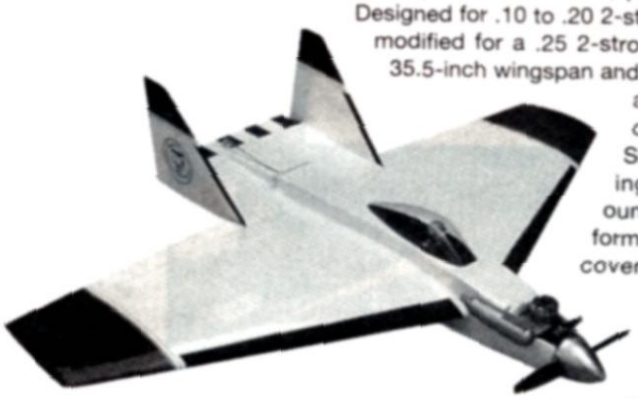
Nelson's Laser-Cut Precision Linkage

It never ceases to amaze me how some guys will build a beautiful scale or non-scale big model and then go and cheap out on linkages. Next to the radio, linkages are probably the most vital components, holding the lives of our models in their "hands." To appreciate them, you've really got to see Nelson's new CAD-designed sub-miniature clevises, bell-cranks, control horns, pull/pull cable systems and pushrods. To give you an example, the four types of bell-cranks are not only ball-bearing, but are also of full-scale, double-truss-style construction. The realistic clevis assemblies and cable attachment fittings systems are ultra-secure and reduce slop to an absolute minimum. Give yourself a treat and your model maximum security. Drop Jerry Nelson a note or give him a call (he's a great guy): Nelson Aircraft Co., 21550 NW Nicholas Court, Unit D, Hillsboro, OR 97124; (503) 629-5277.



LANIER SHRIKE

With the introduction of their Shrike, Lanier RC joins the ranks of combat fliers. This new, all-wood kit is made of balsa, plywood and spruce. Designed for .10 to .20 2-stroke engines (may be modified for a .25 2-stroke), the Shrike has a 35.5-inch wingspan and 329 square inches of area and uses servos of standard size. The Shrike's estimated flying weight is 28 to 38 ounces, and a vacuum-formed ABS landing-skid cover is standard equipment. For more information, contact Lanier RC, P.O. Box 458, Oakwood, GA 30566; (770) 532-6401.



MODEL AIRPLANE NEWS

FIELD & BENCH REVIEW

GLOBAL HOBBY DISTRIBUTORS

Kwik Fly .40

by JACK HAYEK

A classic design turned ARF

OPENING a new kit box always fills me with apprehension and anticipation. In this case, apprehension was unnecessary. The Global* Kwik Fly .40 ARF is a fine kit and a well-constructed ARF. The vivid color scheme really stands out when you view the contents of the box; this bird's bright plumage will certainly make it a very visible flier.

It seems that ARFs are getting better all the time. The quality of this one is quite good. All the main assemblies are straight and true, and the stick-on covering has been neatly applied. The instruction manual reveals a very detailed assembly approach, but some of the photos are vague and difficult to interpret. The photo that illustrates the elevator and rudder pushrod/clevis attachments isn't clear enough. A complete hardware package rounds out the kit, and all you'll need to supply are an engine, a radio, a prop and the usual adhesives and tools.

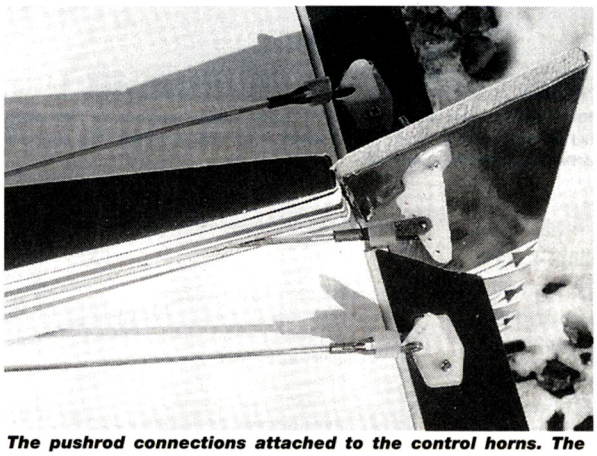
The Global Kwik-Fly .40 ARF is sharp-looking, great flying and very fast. Its vibrant color scheme makes it easy to determine its attitude when it's airborne.

CONSTRUCTION

• **Wing assembly** moved right along because the instructions are very clear. I used 30-minute epoxy to join the wing halves, then I let them dry overnight. From time to time, I checked to make sure that the halves were aligned correctly. The wing joiner determines the dihedral, and the factory-set center ribs ensure a snug fit.

The aileron servo mount required a bit of trimming to allow a standard-size servo to fit. To provide the correct seating for

the aileron servo, I cut out part of the center ribs. Installing the landing gear is easy; just follow the instructions, and make sure the screws and wheel collars are tightly fastened.

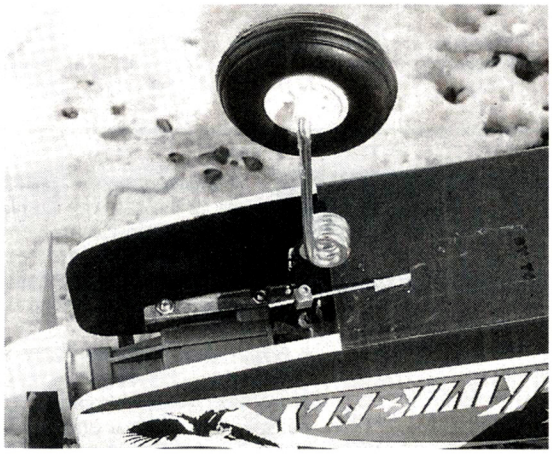


The pushrod connections attached to the control horns. The elevator is the typical Y-connector that runs off one pushrod dowel.

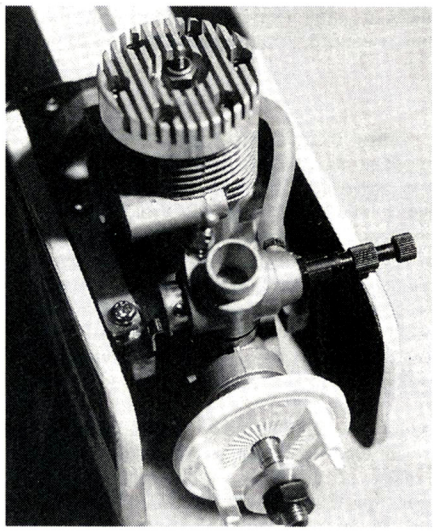
• **Fuselage.** The fuselage servo tray is the first thing you should install in the fuselage. The "leg" portion of the tray must be glued to the servo mount. The photo that illustrates this is clear, but some trimming was required to fit the standard-size servos, as well as a bit more trimming to fit the tray into the fuselage. I did beef up the tray with another layer of plywood so that the screws holding the servos would have something to sink their threads into.

Assemble the fuel tank, and slide it into position. The fuel tubing can be installed after the tank has been positioned, because the front of the tank protrudes through the firewall. Fuelproof the fuel-tank compartment before you install the tank.

• **Engine installation** is a really slick operation. A right offset is required, and it has been built into the mounting. I used the Magnum* XL-.46, which fit quite well in the supplied mount. Check the screws in the pre-mounted engine mount to make sure they're tight.



Nose-gear installation is very simple: file a flat spot in the nose-gear strut where the control-arm fastening screw meets the strut.



Installing the engine is as easy as placing it in the proper position, and clamping it down with the retainer bars. Make sure that everything has been fastened tightly.

• **Empennage.** The tail feathers slipped nicely into place on the fuselage and were secured with 30-minute epoxy; while the epoxy cured, I checked the parts alignment.

• **Pushrod assembly.** Assemble the elevator and rudder pushrods, and insert them into the fuselage radio compartment so that they exit through the slots in the aft end of the fuselage. These slots must be cut out; the manual specifies the correct locations. Elevator and rudder horns can be lined up with the pushrods and then installed in the rudder and elevator. To ensure the most direct route from the throttle servo to the engine carburetor arm, trial-fit the throttle linkage before you install the fuel tank. The bulkhead at the aft end of the fuel tank has several notches through which you can run the cable, but you may want to customize it a bit to get the straightest linkage possible.

• **Radio installation.** I deviated from the instructions in that I installed the switch faceplate on the fuselage side that's opposite the muffler; I prefer this to the push/pull method recommended in the manual. This way, it matches my other models and reduces that "Murphy" factor a bit. Otherwise, the radio components are easy to install in the ample space, and the antenna exits through the *left side* of the

SPECIFICATIONS

Model: Kwik Fly .40 ARF

Manufacturer: Global ARF; distributed by Global Hobby Distributors

Type: sport/pattern

Wingspan: 57 in.

Length: 46 in.

Wing area: 584 sq. in.

Wing loading: 17.7 oz./sq. ft.

Airfoil: semisymmetrical

Weight: 4.5 lb.

Engine req'd: .40 to .46 2-stroke

Engine used: Magnum XL-.46

No. of channels req'd: 4 (rudder, elevator, throttle and aileron)

Radio used: Futaba Conquest FP-T4NFK w/ four S-148 servos

Prop used: Master Airscrew 10x6

Construction: built-up ARF with stick-on covering

Part no. 125600

List price: $179.99

Features: quick assembly and 90-percent complete; colorful finish; light balsa-and-ply construction; complete hardware package and manual; go-where-you-point-it flight characteristics; and enlarged tail surfaces for better stability.

Comments: if you're looking for a low-wing aircraft that flies fast and can really perform, this is the plane for you. It's easy to build and fun to fly; just hold on when you go to full throttle.

Hits

- High-quality ARF construction.
- Magnum engine has plenty of power.
- Great flier.
- Easy to see in the air.
- Great inverted performance.

Misses

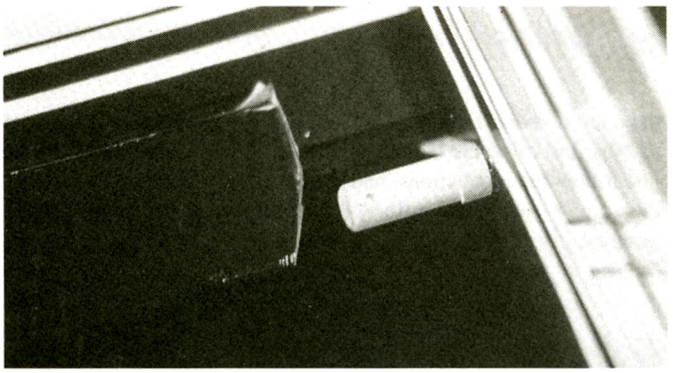
- A few steps in the manual—photos and explanations—could be clearer.

fuselage. The manual specifies "right side,"—an error that will be corrected in future production runs.

Before you install the canopy, you may want to iron on some covering to differentiate the cockpit area from the fuselage covering. The fuselage paint scheme that I received did not accent the cockpit area in any way.

Although there were a couple of minor problems with the clarity of the instructions, the kit and everything that's included with it are topnotch. The Kwik Fly can be assembled quickly, and when it has been completed, it looks very appealing. It took me about three days to finish the kit, and I probably would have finished sooner, but I was distracted by fellow fliers who beckoned me to the flying field. During the test flight, I found the plane extremely responsive. It definitely lives up to its name; at full throttle, it's "Kwik."

The vivid color scheme really stands when you view the contents of the box; this bird's bright plumage will certainly make it a very visible flier.



This is how I angled the aileron ends to allow easier access to the wing hold-down dowels. Also, if the wing shift, this will prevent the dowels from interfering with the ailerons.

• **Final assembly.** One last thought before we go to the field. When I mounted the wing on the fuselage, I noticed that the in-board end of the ailerons was very close to the wing hold-down dowels, and that restricted the fit of the rubber bands on the hold-down dowels. Also, I thought that a small shift of the wing could cause the ailerons to jam against the dowel. A bit of angled trimming on the in-board end of each aileron corrected this.

**Addresses are listed alphabetically in the Index of Manufacturers on page 128.*

About the author

Jack Hayek lives in Danbury, CT, and is enjoying his retirement from IBM. He describes himself as a "flier, not a builder," and tries to get in as much air time as he can at the local FLYRC club field.

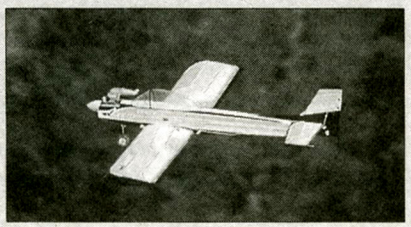
by ROGER POST JR.

FLIGHT PERFORMANCE

After the static photo session, I checked the Kwik Fly over. I had to adjust the ailerons slightly and center the elevator. All control surfaces moved in the proper direction, and a ground-roll test showed a slight veer to the right. I fixed this and checked the model's balance; it was perfect.

• Takeoff and landing

When we test-flew the model, there was a little snow left on the ground. With this snow, we were able to measure the Kwik Fly's takeoff roll—15 feet! We were so astounded by the short takeoff that I landed the plane and tried it again. We got the same result. Without the snow, I'm sure the ground roll would have been about 12 feet. The takeoff procedure for this plane is a piece of cake: advance the throttle, a little right rudder to correct for torque, and before you reach ¾ throttle, the plane is airborne.



When the plane leaves the ground, it's *fast*. Phil Kraft wasn't kidding when he named it the "Kwik Fli." This plane can move and groove, and when I had leveled it off in the downwind turn, I took my thumbs off the sticks, and it flew straight and level—no trimming required. More good news is that the Kwik Fly will fly slowly, so landing it is quite easy.

Keep the plane lined up with the runway, and make the approach with ¼ throttle. Control the descent with the throttle, and flare gently into the touchdown. We didn't have a dead-stick on the test flights, but if you do, I recommend that you keep the flying speed up during the approach.

• Low-speed performance

At ¼ throttle with a little up-trim dialed in, the Kwik Fly flies so slowly that any novice pilot could handle it. Power-off stalls resulted in a gentle nose drop, and only a little throttle was needed for recovery. All the controls remained effective throughout the power-off stall test.

• High-speed performance

This is where the Kwik Fly excels. If you're going to fly this model at full throttle, you should have some low-wing experience and be able to handle a plane that will respond to quick control inputs. I estimate that, at full throttle, speeds exceed 60mph. The plane tracked very well, and to achieve a power-on stall, I had to reduce the throttle slightly; otherwise, the Kwik Fly would have climbed out of sight! Power-on stall recovery needed only the release of the elevator back pressure, and the plane started to fly again.

• Aerobatics

With the recommended control throws, the Kwik Fly's control surfaces have plenty of clout for aerobatics. The rolls were fairly fast and axial, with a little down-elevator needed when it was inverted. The loops needed a little right rudder for straight tracking; their diameters ranged from moderately tight to as large as you'd like. Use plenty of rudder for all the stall-turn, wingover and hammerhead maneuvers; spins, both upright and inverted, were pretty tight when the control surfaces were deflected to the max. Inverted flight needed a little down-elevator and, at one point, I added some down-trim and flew the plane inverted, hands-off; it has very impressive inverted performance!

"Everything old is new again." I think that's how the phrase goes. Anyhow, the original Kwik Fli was designed by Mr. Kraft sometime back in the '60s (I think), so it's truly a pleasure to see it make a comeback through this Global Hobbies ARF. If you're into fast, low-wing pattern planes, or you're in the market for your first low-wing plane, check out this model. You'll be glad you did.

Pilot PROJECTS

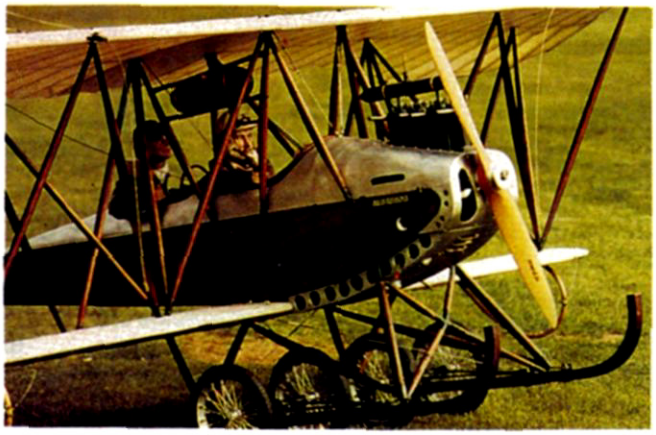
A LOOK AT WHAT OUR READERS ARE DOING

SEND IN YOUR SNAPSHOTS

Model Airplane News is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable. We receive so many photographs that we are unable to return them.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of 1996. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897-3035.



DOPPEL TAUBE

Harald Lohmann of Neustadt Am Rubenberge, Germany, sent this photo of a replica of the 1913 Doppel Taube Albatross Mk. 1. The 10½-foot-span antique scale model is 8 feet long and weighs approximately 40 pounds; a Zenoah G-62 keeps it aloft. The detailed, scale pilot figures are masterpieces in themselves!

EYE-CATCHING EINDECKER

David Hintze of Janesville, WI, sent this photo of his 55-inch-span E-3 that he scratch-built from Ziroli plans. The model weighs 4 pounds and is powered by an O.S. .40 FP engine swinging an 11x6 prop.

JETTING AROUND

Mickey Cline of Bowling Green, KY, built and covered this Great Planes Patriot. He equipped the model with a SuperTigre .45 and retracts. He writes, "I knew the plane would be fast, but I did not expect it to fly 100mph without a tuned pipe!" Mickey depends on a JR radio to keep the pseudo-jet under control.

ELECTRIC RENEGADE

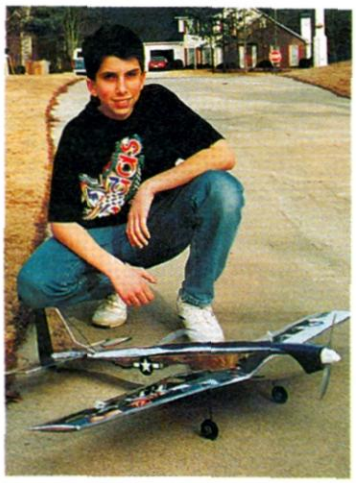
Richard Flinchbaugh of Newport, RI, spent a year scratch-building this 6-foot-span, 72-inch-long model from W.E. Effinger plans. The 7-pound model is powered by a lightened, geared Astro 25 swinging a 13x8 prop on 16, 1700mAh cells with an AI/Robotics speed control. Richard tells us that his Lake Renegade takes off and flies beautifully.

FRENCH PARASOL

This ¼-scale model of the French 1924 ultralight Dormoy Bathtub was scratch-built by Ricardo Calero of Port St. Lucie, FL. The 11½-pound model has a 90-inch wingspan and is powered by an O.S. Max 1.20.

SUPER SUPER CORSAIR

To build this 103-inch-span big bird, Al Culver of Wilder, ID, took *Model Airplane News* Super Corsair plans and doubled their size. The 24-pound model has balsa and foam tail surfaces and three-piece wings, a balsa and ply fuselage and a fiberglass cowl; it's powered by a Walker 4.2ci engine. Al tells us that his Corsair is a "real spectators' plane."



ELECTRIC WARBIRD

Fourteen-year-old Craig Merchant of Peachtree City, GA, drew the plans for this electric P-51 with a ModelCad program. The 42-ounce model has a 47-inch wingspan and is powered by a Great Planes Goldfire .05 motor running on a 7-cell, 1500mAh pack. Craig's Dad, Bob, says that the miniservo elevator and aileron control are enough to make the P-51 loop, stall and roll "like the real thing." It averages 6 minutes per flight.

TIGERCAT

Rick Michelena of McAllen, TX, sent this photo of his latest project—a 1/5-scale Modaire Industries F-7F (shown with his wife, Carla). Rick spent two months building the 116-inch-span, 54-pound model, which is equipped with Likes Line retracts and powered by two Quadra 52 engines. The Tigercat is dressed up in automotive lacquer with a polyurethane topcoat.

AUSSIE NOMAD

This Government Aircraft Factories N24A is the handiwork of Joseph Pobe of Auburn, ME. Joseph scratch-built the 92-inch-span, 13-pound model from his own plans; he finished it in an Alaska Central paint scheme, using Sig Coverall and 21st Century paint. It's powered by two K&B .61 engines and has operational navigation lights and spring-loaded nose gear.

R/C PIGEON

Jose Pico Goicoechea of Asturias, Spain, scratch-built this 1/5-scale model of a Pigeon-Fraser from *Model Airplane News* plans. He says that the 81-inch-span, 52-inch-long plane flies very well and is sensitive to elevator command. An O.S. .91 4-stroke hauls the 10-pound bird through the Spanish skies. +

MODEL AIRPLANE NEWS

HOW TO

This great-looking P-82 twin Mustang is an exciting plane that many modelers would like to build. But how do you make the transition from a single to a twin? A simple modification to an existing trainer will do the trick.

Build a Simple "Hammerhead" Twin

by CHARLIE VIOSCA

RECENTLY, A FRIEND gave me a .60-size Ugly Stik. I decided to make a twin-engine plane out of it, but I wondered how much work this conversion would entail. When it was time to take off the wing covering and make the necessary modifications, I had a bright idea; I knew I could simplify the job.

Because the original power was a .60, I decided that two .40s would be right for the conversion, and I selected two O.S.* .40 FPs. As it turned out, these were a good choice. (I might add that the model now looks like a hammerhead shark.) The converted twin Ugly Stik flies well on two engines, which together make a really sweet sound. The model will also fly and do loops and rolls on one engine, and it will climb out on one engine if the other quits on takeoff. I also believe that I will be able to accomplish a single-engine takeoff with my model, so I hope to fly it off a paved strip. The grass field on which I fly is too rough for this. I can keep the plane straight, but it will not accelerate to flight speed on the grass and rough ground.

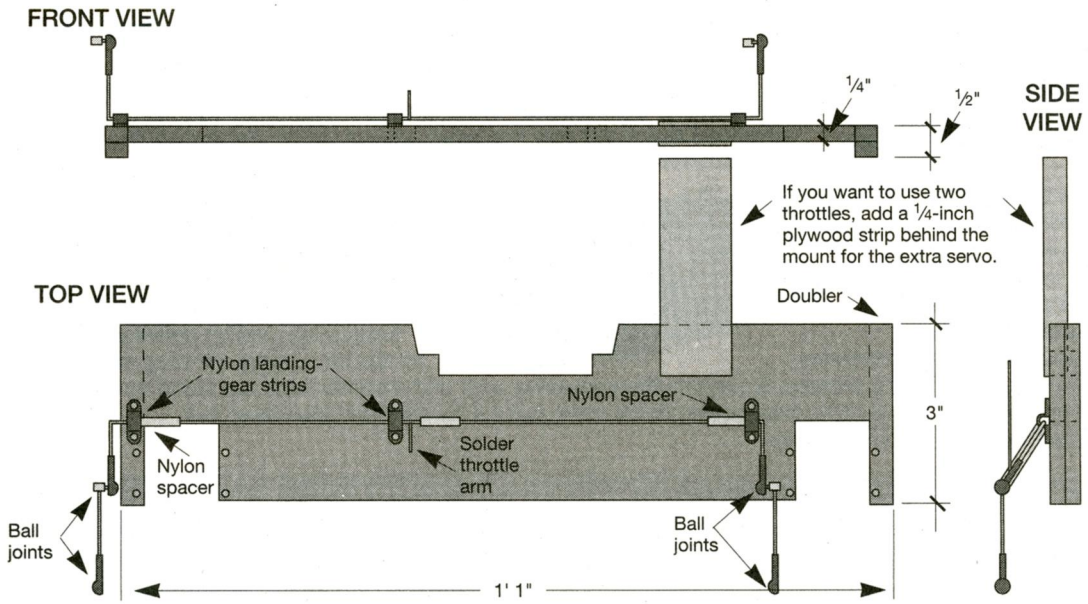
ENGINE MOUNT

• Follow these simple instructions and refer to the diagram and photos. For the engine cut two openings in a 13x3-inch piece of ¼-inch-thick aircraft plywood, coming in ⅜ inch from each side. For strength, add a piece of ⅜x3¼-inch plywood to the underside of the outside mount area. To run both engines with one throttle servo, make a throttle rod as shown on the diagram. I used a Futaba* 4-channel Conquest radio with this option.

• If your radio has mixing options that allow you to mix a channel with the throttle, you should consider doing so; this will permit you to practice flying on one engine. I suggest that you use the mixing switch and run both engines off the normal throttle position. When you turn off the mixing switch, you will be able to throttle back one engine and fly on the other. To run each throttle separately, you will need to add a servo plate to the rear of the left engine as shown on the diagram. Mount the master throttle servo (left engine) on this plate.

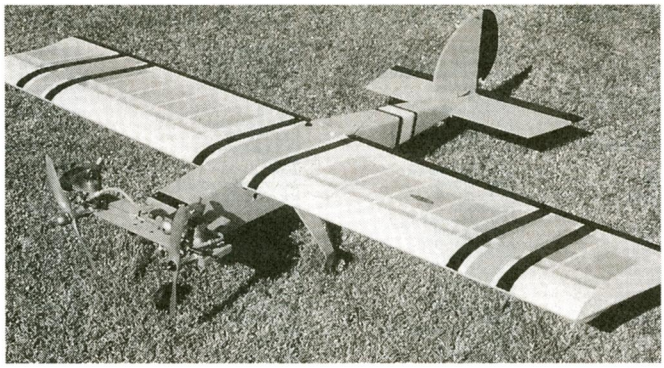
I have a Futaba 7UAPS radio installed in my trainer. I use channel 3 for the left engine and channel 7 for the right one; I mix the two channels so that I can throttle back either engine to practice flying on one. When the channels are mixed, the normal throttle works both engines. This system works very well.

• If the servo is installed behind the left engine, it gets messy with oil. Find a place for the servo inside the fuselage, or install it in the front center of the engine-mount plywood. Connect the servo to a split throttle rod that goes to the left engine while the original servo runs the right one.



The engine-mount beam is a simple piece of plywood notched to accept two engines. The center notch will accept the original engine mount and the firewall of the model.

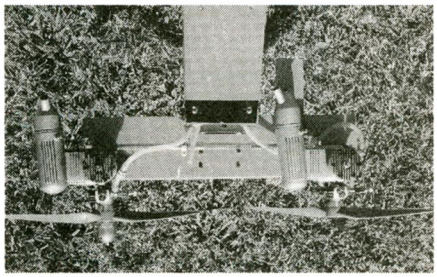
PHOTOS BY CHARLIE VIOSCA



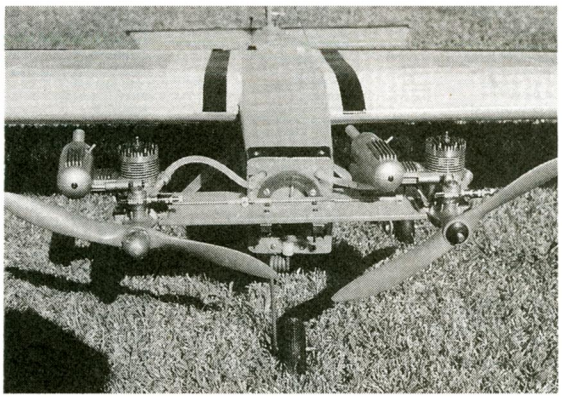
Here's my hammerhead twin—a modified .60-size Ugly Stik. Using this simple twin-trainer configuration will give you valuable experience operating a twin-engine aircraft yet will minimize the potential for problems associated with a true twin.

INSTALLATION

You shouldn't have any problems using the .60-size tank, but for the most reliable fueling system, you'll want two pick-up lines: one for the left engine and one for the right one. To fill the tank, run fuel through the right engine's feed line while pinching off the left engine's fuel line to avoid flooding the engine during fueling. Don't use a T-fitting in one fuel line; doing so will create all kinds of problem.



This top view shows the simple engine-mounting system. The plywood engine-mount beam is attached to the original single engine's mount. The entire modification takes only a few minutes, and you can reconvert it to the stock single-engine configuration at any time.



Front view. Note the separate fuel lines that lead to the engines. Although you can use one fuel tank, two are more reliable; just don't feed them with a single, fuel, pick-up line with a T-fitting. This can cause uneven fuel flow to the engines.

After you cut out the engine-mount holes, sand the plywood and paint it to match your plane. Now you are ready to mount this unit in place of the old engine. Place the unit, centered, on top of the old engine mount, and mark the old engine holes; then drill them, and secure the unit to the firewall with 6-32 screws, washers and locknuts. If the engine mount is slanted off-center, add shims to get the correct twin-mount level. Mount the two .40s, and hook up the throttles.

Although I converted an Ugly Stik, any good, stable trainer can be converted by this same method. I'm sure you will be able to modify a .40-size trainer to a twin that flies on two .30s. To compensate for the added weight, I recommend that you use two engines that are each about two-thirds larger in size than the original. One word of caution: be absolutely sure the model is well-balanced; tail-heavy twin-engine models do not fly well.

That's all there is to it. Go fly your twin, and have fun!

**Addresses are listed alphabetically in the Index of Manufacturers on page 128.*

TWIN-ENGINE PROCEDURES

- Listen to engine sounds.
- Watch for yaw; when one engine quits, apply rudder opposite the yaw, then apply trim.
- Keep up your speed.
- Coordinate your turns.
- On takeoff, attain a higher speed than you need to be able to control the model in an engine-out situation.
- During a landing, when you have the field made, throttle back and land.
- Watch for opposite yaw when you throttle back; if it's excessive, trim it out.
- If you have to go around, apply throttle slowly, accelerate, and don't climb too steeply.

About the author

Charlie Viosca of Dallas, TX, has competed at the AMA Nationals, where he took third place in Scale in 1974. Among his modeling accomplishments, Charlie has built a scale model of Betty Skelton's "L'il Stinker" Pitts Special biplane that is now in the Smithsonian's Air & Space Museum. Recently, the Smithsonian has started to restore the original Stinker using Charlie's model as a guide for the reproduction of the aircraft's color scheme.

Flying a Twin

I've heard people say, "When an engine quits, cut the throttle and land" and "Don't turn into the dead engine." I disagree. You'll just use different strategies when you fly a twin-engine model; here are some of them.

When you fly any model airplane, rely on visual and audible clues to alert you to problems. For example, to tell whether an engine is out, watch for yaw, and listen to the sound of the engine. When an engine quits, the model will yaw toward the engine that is out. If it's the left engine, yaw is to the left. To correct left yaw, apply right rudder. Once you've determined that your action is correct, use the aileron and rudder trim to hold the wings level; applying full trim will usually hold the model straight. If full trim does not correct the problem, keep the wings level by holding right rudder with the stick.

"Minimum control speed" is the speed at which the aircraft that has one engine out is able to maintain straight flight with rudder correction and full throttle. Slower speeds will allow the aircraft to turn toward the disabled engine. If you don't take corrective action, disaster is certain. Lower the nose to gain airspeed; to hold it straight, throttle back on the good engine, if necessary. This is why we have to keep up the model's speed; we don't know how fast it is going. When one engine quits, take appropriate action; then you can fly the model on the remaining engine. You'll be able to make turns into the dead engine or toward the good engine; the secret is to coordinate the turns.

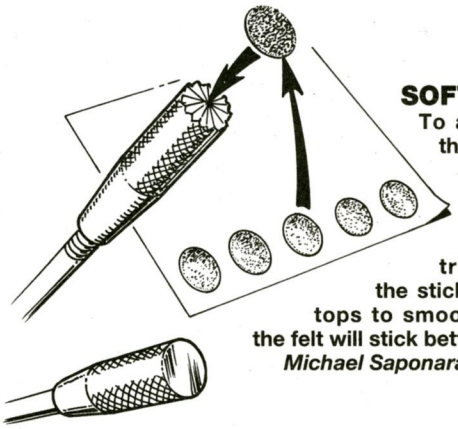
The most critical time to lose an engine is on takeoff. If you are below minimum control speed, the aircraft will run off the runway on the side of the dead engine. If you have lifted off but you have not reached minimum control speed, the model will probably snap-roll in the direction of the engine out. Speed is your ally; therefore, on takeoff, attain as much speed as possible, and slowly rotate and climb out at a shallow angle. If you lose an engine, you'll still be able to control the model.

When you make your landing approach, keep your speed up, and when you have made the field, throttle back on the good engine, and execute a normal landing. Watch for yaw toward the good engine, and if it's excessive, trim it out. Remember; you had to trim opposite the dead engine, so this trim will now cause yaw toward the good engine. If you have to go around, apply power slowly, and accelerate before you climb. Make your climb-out shallow, and remember to coordinate your turns.

Hints & KINKS

by JIM NEWMAN

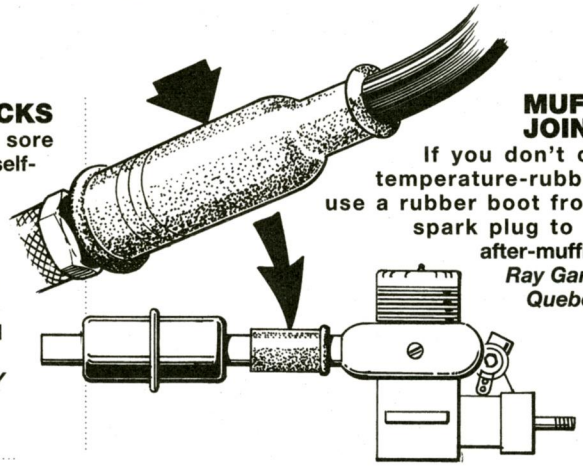
Model Airplane News will give a free one-year subscription (or one-year renewal, if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o Model Airplane News, 251 Danbury Rd., Wilton, CT 06897-3035. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.



SOFT-TOP STICKS

To avoid getting sore thumbs, apply self-adhesive felt circles to the top of each control stick. File the sticks' removable tops to smooth them, and the felt will stick better.

Michael Saponara, Flushing, NY



MUFFLER JOINER

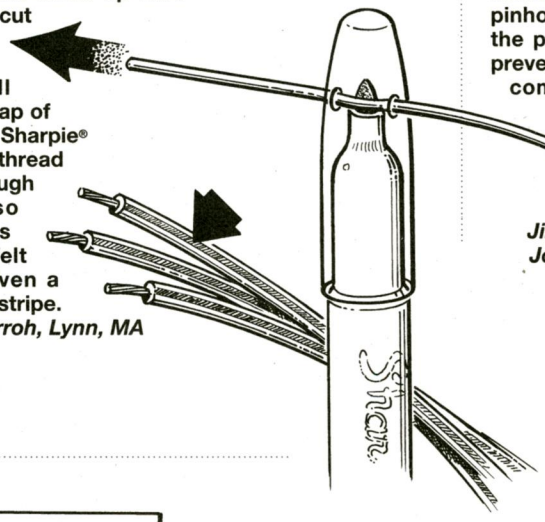
If you don't own high-temperature-rubber tubing, use a rubber boot from a car's spark plug to attach an after-muffler.

Ray Gareau, Laval, Quebec, Canada

STRIPEY WIRE

To save money, color-code your wires yourself. Buy white hook-up wire in rolls, then cut the wire into suitable lengths. Drill through the cap of a permanent Sharpie® marker; then thread the wire through the holes so that it rubs against the felt tip and is given a color-coding stripe.

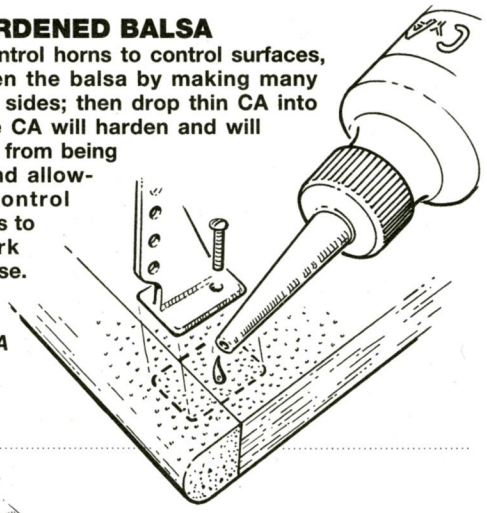
Bob Charroh, Lynn, MA

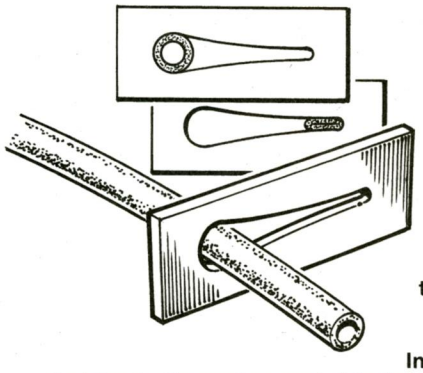


HARDENED BALSA

Before bolting control horns to control surfaces, thoroughly harden the balsa by making many pinholes on both sides; then drop thin CA into the pinholes. The CA will harden and will prevent the balsa from being compressed and allowing the control horns to work loose.

Jim Weyman, Johnstown, PA

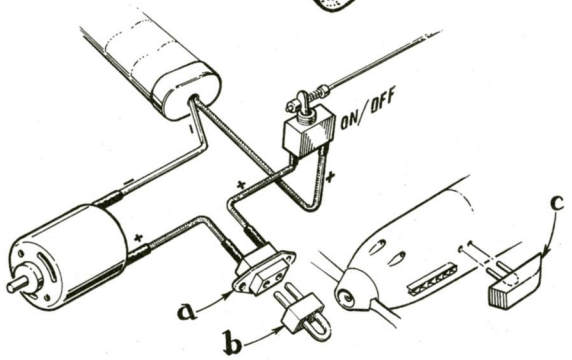




SIMPLE SHUT-OFF

Make plastic restricters, like the ones used on intravenous injection bags, out of 40/1,000 to 60/1,000-inch-thick (1mm to 1.5mm) plastic. Install them on the fuel line to the engine, and slide them along to squeeze the line shut while you refuel, therefore avoiding flooding the engine while you do it.

Max Monce Jr., Brazil, IN



ELECTRICAL-SAFETY ARMING PLUG

If the transmitter throttle is left forward when you switch on the receiver, your electric model will go to *instant full power—highly dangerous!* Break the battery's positive lead with a phono or two-pin socket (a). Fit the shorted plug (b) only when the model is set on the runway, ready for takeoff, *after checking that the throttle is closed.* You can disguise the plugs. My Me 109 plug is disguised as the supercharger intake (c). For simplicity, the fuse is not shown.

W.J. Johnson, Hope Hull, AL

MODEL AIRPLANE NEWS

FIELD & BENCH REVIEW

An exciting sport/pattern model

PHOTOS BY JOHN, WHITNEY & STEPHEN PHILBRICK

by JOHN, WHITNEY & STEPHEN PHILBRICK

The authors and the plane (left to right): Whitney, John and Stephen Philbrick.

BRUCE THARPE ENGINEERING

Venture 60

BRUCE THARPE of Bruce Tharpe Engineering* (BTE) is an experienced designer, and the Venture 60 shows that he has learned his trade well. He has put your money into what counts: an excellent design, well-prepared wood, clear instructions and outstanding plans, and he throws in a good collection of hardware and superb, large decals. The photo-illustrated instruction book is very well-written; follow it precisely because Bruce has thought it through and explained it well.

CONSTRUCTION

The fuse is made of cut, sanded, lite-ply parts, including one-piece, full-length fuselage sides. A doubler strengthens the front of the fuselage. The engine-mounting holes are drilled in the firewall, and you must install the blind nuts before you assemble the fuselage. Then glue the interlocking fuselage parts together with CA for a strong, self-aligned structure.

To shape the fuselage at the tail, you must carve and sand some blocks of wood. The blocks at the rear also help ensure accurate alignment of the vertical fin and the horizontal stab. The stab slides into a slot in the sides. The front top is formed with two pieces of light balsa butt-jointed together then carefully curved over the tops of the leading three formers. The turtle deck behind the canopy is made of stringers pressed into slots in the top of the rear formers. A precut plywood piece supports the fuel tank in the front of the fuselage.

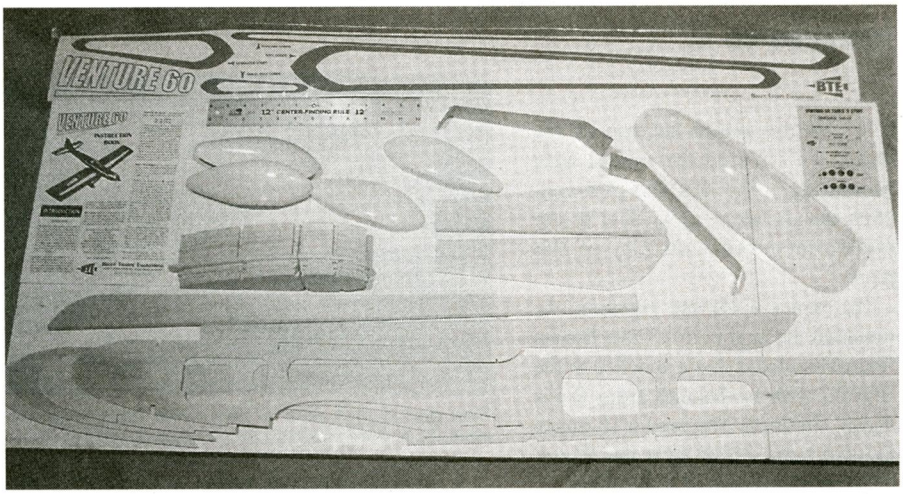
The landing gear is formed of two shaped pieces of aluminum bolted to a massive plywood block immediately in front of the wing. The gear's sweptback design places the wheels just in front of the CG for good ground handling. We used Dave Brown* light wheels.

The tailwheel is supported by a Du-Bro* nylon bearing that's epoxied into the end of the fuselage and supported by a carefully soldered washer. Follow Bruce's instructions here, and make sure that the hinge turns freely (a little oil helps).

Wheel pants are optional, but they add a lot to the model's appearance. Ours weren't of the same quality as the rest of the parts in the kit, but with a little work, they wound up being stronger and better mounted than those we've seen in other kits.

WING AND TAIL

Wing construction is straightforward. Key to this wing's light weight and strength is the central I-beam spar formed of

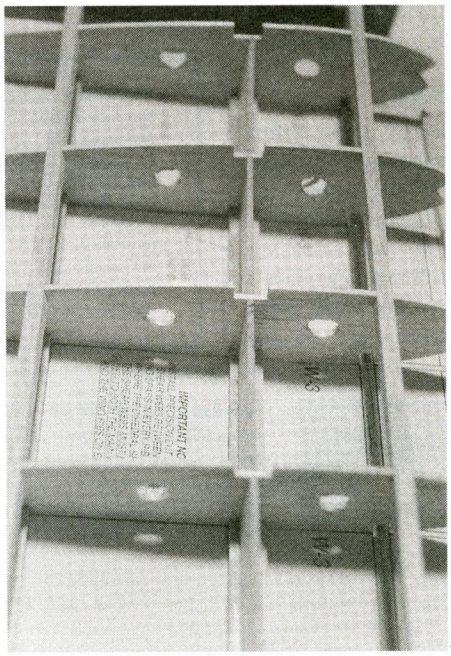


This selection of parts includes the full-length plywood sides, precision-cut ailerons and elevators, large decal sheets, instruction book, aluminum landing gear and clear plastic canopy.

1/4x1/2-inch spruce spars and precision-cut balsa webs that fit between the ribs. A single, large, aircraft-plywood joiner slides into the gap between the top and bottom spars on both sides.

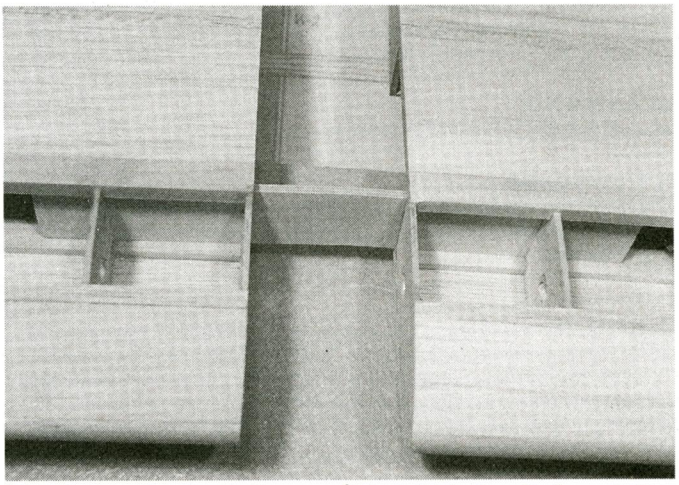
We covered the sheeted center section of the wing with fiberglass and extended it farther outward than BTE called for. Instead of attaching the fiberglass to the sheeting with CA as recommended, we used EZ Lam epoxy laminating resin from Aerospace Composites*. Either approach works.

The design calls for a single, center-mounted servo to drive the ailerons. We chose to use two servos, mounted outboard, and ran the leads through holes drilled in the ribs. Bruce says that a number of his builders have done the same, and some claim to have achieved improved roll rates.



This shot of the wing construction shows the strong central I-beam spar and annotated plans.

The elevators are of conventional, two-piece, wire-joined construction. The fin is made of three pieces of balsa, and the stabilizer is made of two large pieces (grain running spanwise) glued to a spruce spar with end pieces (grain chordwise) at the tips. This forms a strong, warp-resistant structure.



The wing construction features an 1/8-inch-thick aircraft plywood dihedral brace.

SETUP

At initial assembly, the wing and stab incidences were as called for on the plans, and very little trimming was required to align the tail surfaces with the wing.

The wing is attached with two dowels in the leading edge that mate with two holes drilled in a reinforced former. We strongly believe that the 1/8-inch lite-ply attachment plate inside the wing is too weak, and we reinforced it with a piece of 3/32-inch-thick plywood glued to both adjacent ribs and to the spars. If you choose to extend the fiberglass covering as far out as we did rather than using BTE's 2-inch fiberglass strip, you should drill these holes after applying the fiberglass. We drilled and tapped the holes for the hold-down bolts with the wing in place.

After applying Coverite's* Balsarite to the bare wood and F&M Enterprises* Stits Feathercoat to fill the grain of the fiber-

SPECIFICATIONS

Model: Venture 60

Type: low-wing sport aerobatic plane

Manufacturer: Bruce Tharpe Engineering

Wingspan: 72 in.

Wing area: 876 sq. in.

Weight: 7 lb. (manufacturer's specs—7 lb., 4 oz.)

Wing loading: 18.41 oz./sq. ft.

Length: 53 in.

Engine req'd: .60 to .65 2-stroke, .65 to .80 4-stroke

Engine used: .80 Saito 4-stroke

Prop used: 15x6 APC

Radio required: 4-channel

Radio used: Airtronics 6-channel Quasar FM (one 94102 servo, four Hitec HS 422 servos)

List price: $119.95

Features: balsa and ply fuselage; wing is open construction of balsa with spruce spars; precut plywood; many precision-cut and shaped balsa parts; ribs all precut and sanded; rolled plans; complete hardware package; optional wheel pants.

Comments: with its light wing loading, thick airfoil and powerful engine spinning a big prop, the Venture 60 is an excellent plane for someone who's starting to enjoy aerobatics or even for a pattern pilot who's looking for something a little different.

Hits

- High-quality precut and shaped parts.
- Interlocking fuselage construction.
- Light, strong construction.
- Excellent instructions.

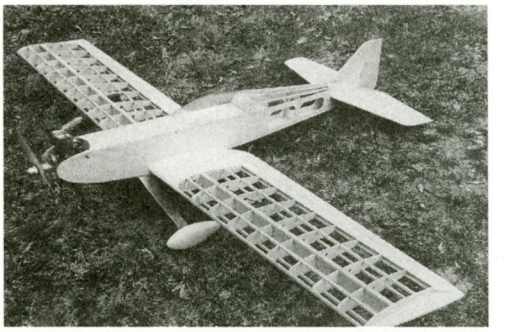
Misses

- Weak wing attachment plate (in wing).
- Optional wheel pants not up to the quality of the rest of the kit.

glass on the center section of the wing, we covered the model with MonoKote*. The supplied peel-and-stick decals add a great deal to the appearance and visibility of the plane.

To reduce noise and vibration, we mounted the engine in a Dave Brown fiberglass mount that's attached to the firewall with Iso-Mounts from Davis Model Products. We used a 16-ounce Du-Bro tank, which gave our Saito* .80 over 12 minutes of flight time.

We covered the plane and *then* installed the radio and servos; this allowed those components to be moved to help balance the plane. BTE supplies control rods of square cross-section balsa rods plus wire ends. We used a Du-Bro switch/charging-jack mount to support those components.



This bare-bones shot of the plane highlights the sweptback landing gear and open-wing construction.

SUMMARY

With its light wing loading, thick airfoil and powerful engine spinning a big prop, the Venture 60 is an excellent plane for someone who's starting to enjoy aerobatics or even for a pattern pilot who's looking for something a little different. The decals make it very visible, and the wheel pants add to its attractive appearance. We are delighted by this plane, and Bruce Tharpe supports it with prompt, personal answers to phoned-in questions and by quickly shipping necessary parts.

**Addresses are listed alphabetically in the Index of Manufacturers on page 128.*

About the author

Dr. John Philbrick has worked in industry and academia as an administrator, manager, computer scientist, marketer and physicist. He flew CL in the '50s and taught his sons, Whitney and Stephen, to build and fly CL in the '70s. Whitney, who is interested in scale warbirds, taught his Dad to fly R/C in the '90s. Stephen enjoys the detail work and color schemes that make a plane attractive and visible.

FLIGHT PERFORMANCE

We took the usual ground photos and showed the model off to the curious, then we checked balance, battery power, control movements and radio range. We then fired up the Saito. It barked to life on the first try and provided an aggressive pull, though we weren't able to get it up to full rpm because of some throttle-linkage problems.

Whitney taxied it out, then pointed it down the runway and opened up the throttle part way. The tail rose; the Venture needed just a little help with the rudder to stay straight, and then it lifted off smoothly. It needed some up-trim (we may have had too much downthrust) and a little aileron adjustment to fly hands-off. Then the fun began.

• *Takeoff and landing*

Takeoffs are easy, with the exception of a slight tendency to nose over on our grassy field until the propeller and elevator can control the tail movement. Tracking is good; liftoff comes after a short run. Landings are a dream. The plane floats in across the boundary and settles smoothly for a mains-first landing.

• *Low-speed performance*

Superb—it "floated" and exhibited no bad characteristics.

• *High-speed performance*

Speed was limited because of the throttle-linkage problems (our fault!) mentioned earlier. Nevertheless, the plane was stable in a high-speed dive. We're confident that it would perform well at high speeds.

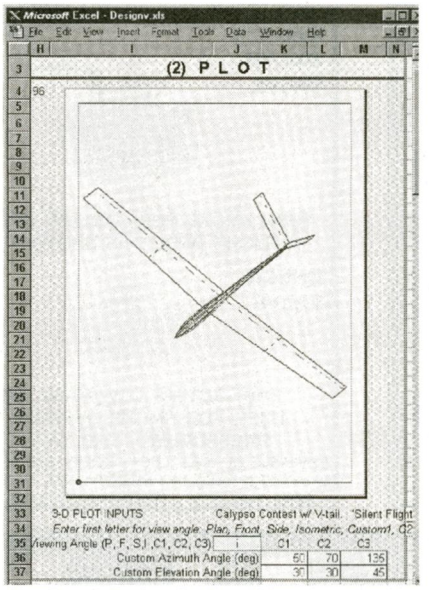
• *Aerobatics*

Fun! We used a high-power, low-speed engine and prop combination that yielded almost constant-speed aerobatics. Its verticals were long with the potential for a torque roll at the top. Loops were smooth and large and needed little correction. Roll rate seemed comfortable, although we may increase the recommended aileron throw in view of our slow flight. Inverted flight was very stable. In short, the Venture 60 seems capable of almost any maneuver we can do, and it can do them all at a slow enough speed for a beginning aerobatic pilot to handle.

Center ON LIFT

by MIKE LACHOWSKI

SOARING IN THE COMPUTER AGE

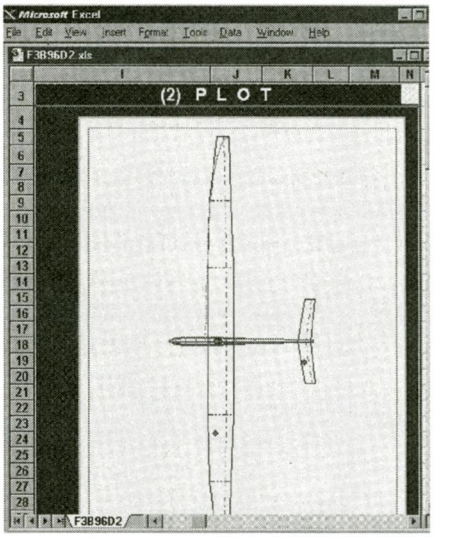


Here's a 3-D sketch of a glider generated by the Plane Geometry computer program.

I keep finding new and interesting ways to use my computer to improve our hobby. This month, I discuss a computer-radio comparison chart, a low-cost program that collects weather information and a set of programs that help you evaluate and design models.

COMPUTER RADIO

Many of us wouldn't want to live without our computer radio. Among the radios introduced in the past year are the Airtronics* Stylus (this replaced the classic Vision), Futaba's* new System 8, and JR's* XP783 and XP8103. If it's time for you to buy a new radio, you'll be able to comparison shop more easily if you have a way to organize information about different models. Don Edberg's latest Radio Comparison Chart includes details on both available and discontinued radios sold in the U.S. For a well-spent $5.50, you'll receive two pages of information and several additional pages of commentary, along with a handy sailplane trimming chart. Contact Don at Dynamic Modeling, 4922 Rochelle Ave., Irvine, CA 92714-2941; 72417.2067@compuserve.com.

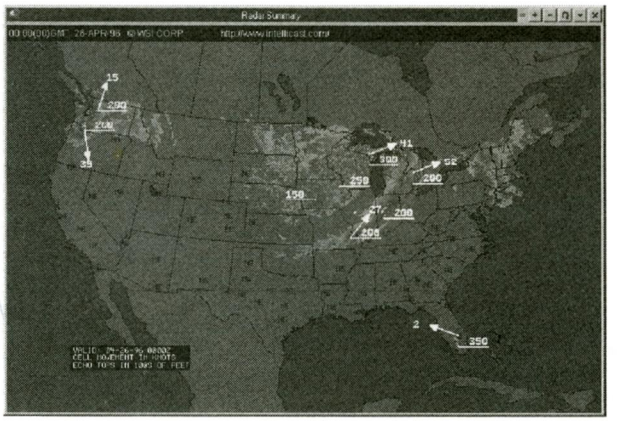


With help from Plane Geometry, you can design and modify model airplanes.

WEATHER INFORMATION

Soaring pilots need to know what kind of flying conditions to expect. The televised Weather Channel is a great source of weather information, but so is the Internet. A really nice shareware program called *WinWeather 2.0* will help you find and keep track of weather information. The program pulls in hourly weather reports and forecasts; if you configure it for your nearest forecast location, you won't need to remember addresses or navigate through bookmarks in your Web browser. I use the program to obtain local weather information and regional forecasts.

The main *WinWeather* window uses animated icons to display the temperature, pressure and wind and weather data for selected cities. For more details, hit the forecast button to see a text description of the latest forecast. Because the program works with text, it's quick; the latest version of the program has access to image data. Use the configured image locations, or add your own. For a sample of the program, visit the *WinWeather* home page at http://www.igsnet.com/igs/; or try Tucows at http://www.tucows.com. You can also contact Adam Stein at Insanely Great Software, 126 Calvert Ave. E., Edison, NJ 08820; sales—(800) 319-5107; voice—(908) 548-5107; fax (908) 632-1766.



For up-to-the-minute weather reports from your computer, try a shareware program called WinWeather 2.0.

"PLANE GEOMETRY"

Plane Geometry is a great set of programs that measure aircraft geometry; the measurements can be used to design and modify model planes. Other programs compare sailplane performance based on wind-tunnel data, but they aren't much use for designing or modifying. *Plane Geometry* fills those needs. It won't automatically design a model for you, but it quickly and easily makes all the calculations for standard aircraft configurations. It produces a nice, 3-D sketch of a model's design, too! *Plane Geometry* works for models such as typical gliders, but not for canards, biplanes, or any strange configurations; you'll need to use different worksheets for V-tail and conventional-tail aircraft.

Two programs in the set calculate characteristics based on the model's measurements. The measure program calculates geometric characteristics after you've entered dimensions; use the results to compare designs in the 3-view data mode.

Center ON LIFT

Plane Geometry calculates span, area, aspect ratio, taper ratio, dihedral and mean aerodynamic chord. Because the model's entire geometry is there, the program is also able to calculate moment arm between the wing and tail, tail volume and some stability derivatives; these include measurements of elevator and rudder-control power and pitch-damping characteristics. If you're not familiar with these, a 30-page manual explains them.

THERMAL PRACTICE TIP—BALLAST FOR FLYING WEAK LIFT

It's a challenge to fly in weak lift. To improve your skills, add ballast to your model. Now, go out and fly with your friends; try to "work" the same air currents that they use. The extra ballast will make circling and centering with extra speed even more difficult; but if you closely observe how your plane handles, you'll be better prepared to fly in windy weather, when added ballast is needed.

When you want to change a design, the measure program calculates the design program's input values; adjust these to modify the model. Almost all the design program's input is in the form of angles and ratios. Add a wingspan, and you'll get the measurements of the full-size model. This is just a short description of the program's capabilities; its output is detailed and very complete. A nice feature of the design program's 3-D view is a plot that compares the wing planform with an idealized elliptical planform.

Use *Plane Geometry* to answer questions such as, "Where should the CG be?" "What incidence angle do I use, and how much dihedral?" "How large should I size a V-tail to replace a conventional tail?" It's also great to determine whether a plane would fly as well as a scale model.

Plane Geometry is available for a PC or a Mac equipped with Microsoft Excel v.4 or higher. It's a bargain—$19.95, plus $2 shipping and handling. Contact Envision Design, 4207 Exultant Dr., Rancho Palos Verdes, CA 90275.

I hope that you have been busy practicing and that you find my thermal practice tips helpful. See you at the LSF Nats!

**Addresses are listed alphabetically in the Index of Manufacturers on page 128.*

by ANDY G. LENNON

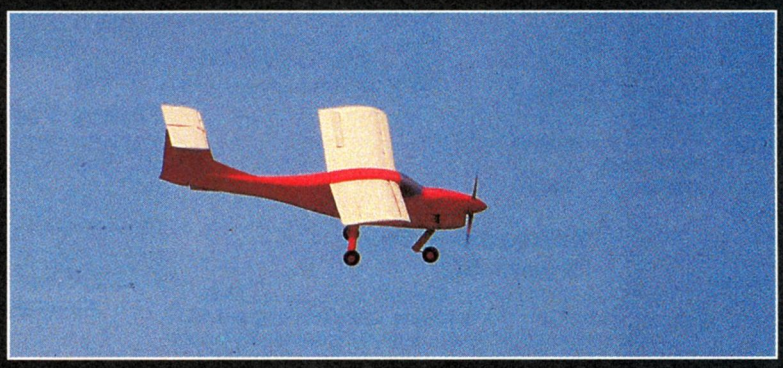
A sport model that incorporates high-lift devices

MODEL AIRPLANE NEWS
CONSTRUCTION

S.T.O.L. Crow

THE CROW'S aerodynamics and structural design follow the principles outlined in this author's series of design articles—particularly "High-Lift Devices and Drag Reduction" (*Model Airplane News,* May and July '96) and "Design for Aerobatics" (future issue).

Its wing incorporates leading-edge slots and 30-percent-chord slotted flaps; both are full span. These two high-lift devices double the wing's maximum lift coefficient to 2.31 and result in a tail angle of 16 degrees—in ground effect and with flaps fully extended. The rear fuselage was upswept to avoid the need for "too-long" landing-gear legs. Despite its moderately high wing loading of 25.4 ounces per square foot, stall speed, flaps down, is 16mph.

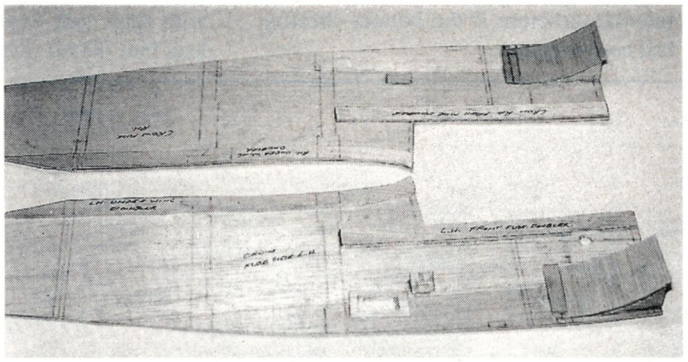


The Crow in flight; it's a smooth flier and can take off and land in a very short distance.

This clearly shows the leading-edge slots, full-span flaps and slot-lip ailerons.

Full-span flaps prevent the use of conventional ailerons. Instead, slot-lip ailerons are used. These are a type of spoiler that forms the slot lip. They have been proven to give a brisk roll rate, they work inverted, and they're very crisp when the flaps are extended. Only one operates at any one time—the one on the inside of the turn. Instead of adverse yaw, they provide favorable, into-the-turn yaw. Spring loading closes them.

To give the horizontal stabilator more authority in achieving the high landing angle of attack, it's equipped with inverted, full-span leading-edge slots. Careful attention has been given to drag reduction. A cruising speed of 60mph was selected so that the wing and horizontal tail angles of incidence could be determined.



The fuselage side sub-assemblies.

Both the gross weight of 87.5 ounces and the CG location agreed with estimates (for once!), but after early test flights, the right-hand slot-lip aileron had to be slightly raised for lateral trim.

Suspecting that the left wing was heavier than the right, I picked the model up to check. Holding the prop tip vertical—out of engine compression—and holding the fin at the horizontal-tail trailing edge, I confirmed the imbalance. Two 1/4-ounce Du-Bro* stick-on lead slugs embedded in the right-hand wingtip corrected the problem and raised the model's fueled weight to 88 ounces. Subsequent flights required no trim adjustment.

The Crow's low weight-to-power ratio of 191.3 ounces per cubic inch of engine displacement permits very short, steep takeoffs, flaps half extended; and the high-lift devices permit slow, short landings with flaps fully extended—true STOL performance.

When you order the plans—see the Pilots' Mart toward the back of the magazine—you will also be sent complete construction notes and photos. When you make the components, whether they're

SPECIFICATIONS

Model: Crow STOL

Designer: Andy G. Lennon

Wingspan: 57.5 in.

Wing area: 500 sq. in. (3.47 sq. ft.)

Weight: 88 oz. (gross)

Wing loading: 25.4 oz. per sq. ft.

Length: 40.5 in.

Horizontal tail area: 112 sq. in.

Engine req'd: O.S.* Max .46 SF or equivalent

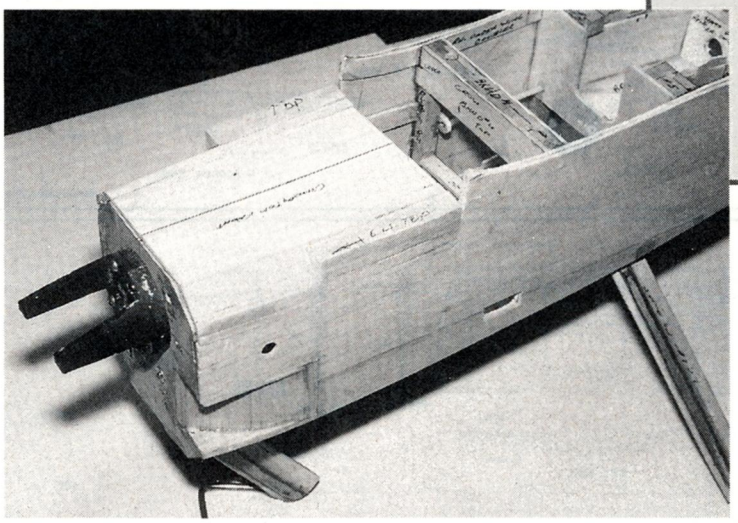
Power loading: 19 1/3 oz. per ci displacement

Prop: APC* 11x6 or 11x7

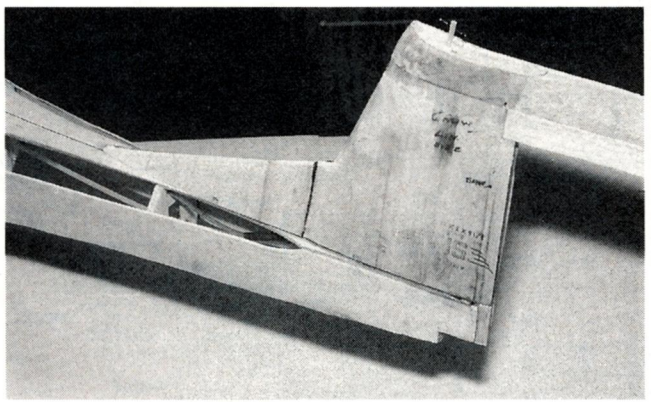
Airfoils: wing—E197; tail—E168

Features: full-span NACA fixed LE slots; full-span slotted flaps—30 percent of wing chord; slot-lip ailerons for roll control, horizontal stabilator with inverted LE slots.

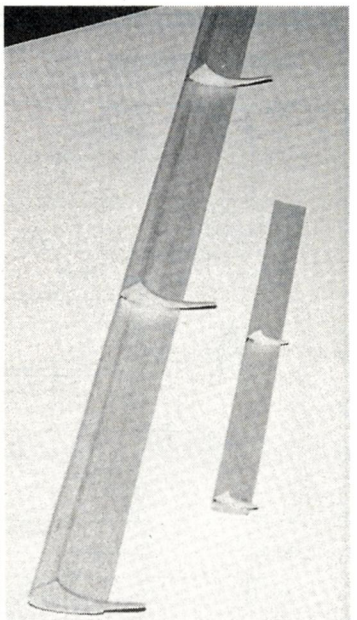
Comments: with the flaps halfway down, the Crow will take off in 10 feet. With the flaps fully deflected, you can point the nose down to a 45-degree angle and land the plane in a very short distance without building up any airspeed. With flaps deflected, the slot-lip ailerons are extremely effective and provide a crisp roll rate.



The front of the fuselage showing canopy base construction.



Left: the flap-support ribs sub-assembly and the jig. A 3/32-inch-diameter music-wire pin in the jig positions the critical flap pivot point. Right: the fin assembly has been installed on the fuselage. At this stage, the elevator and rudder cable sheaths should be installed, and a strong cord should be run through the antenna tubing and bulkheads to the receiver box. When the horizontal stabilator is installed, this cord will be used to pull the antenna through to the receiver box.

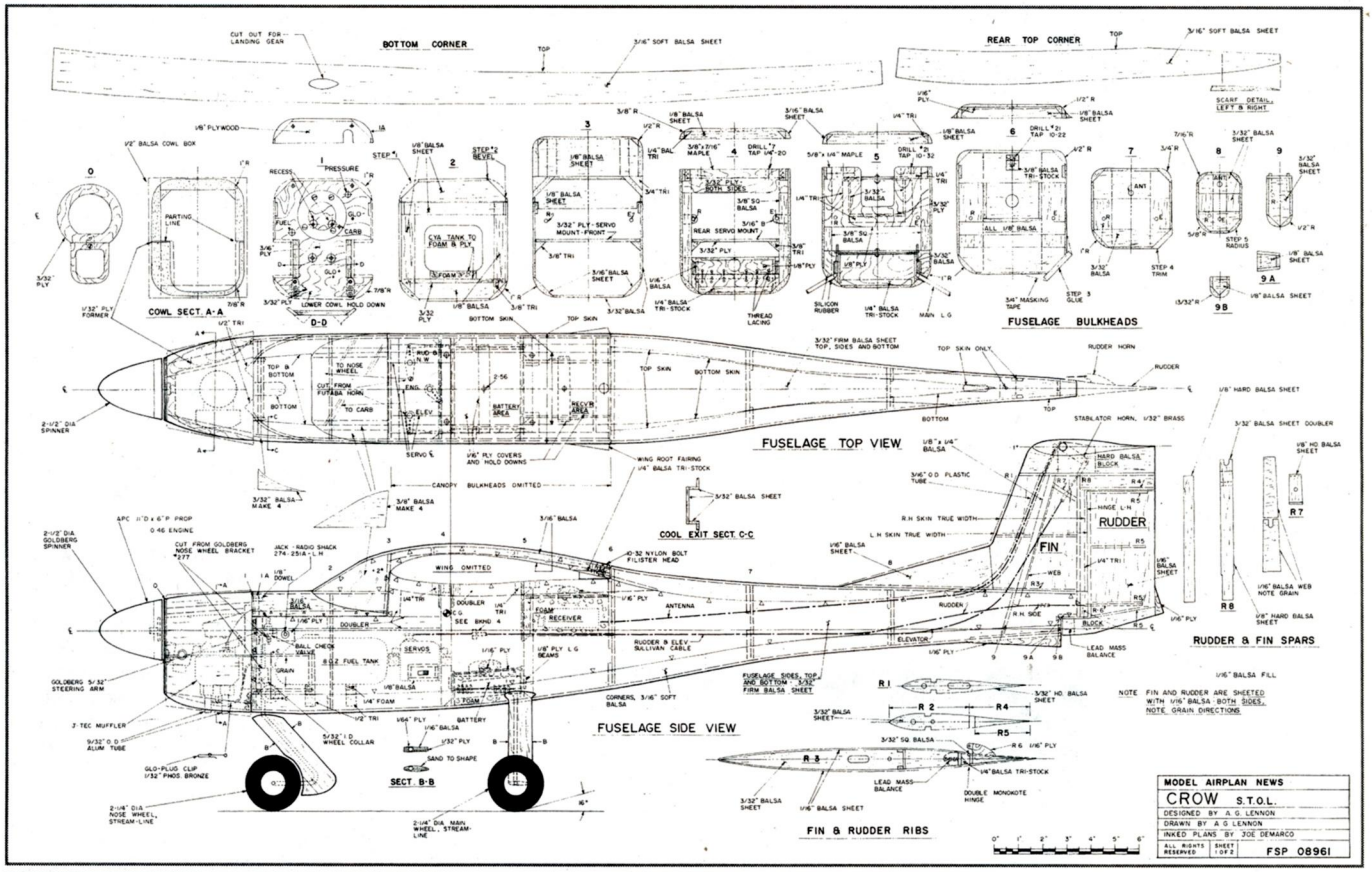


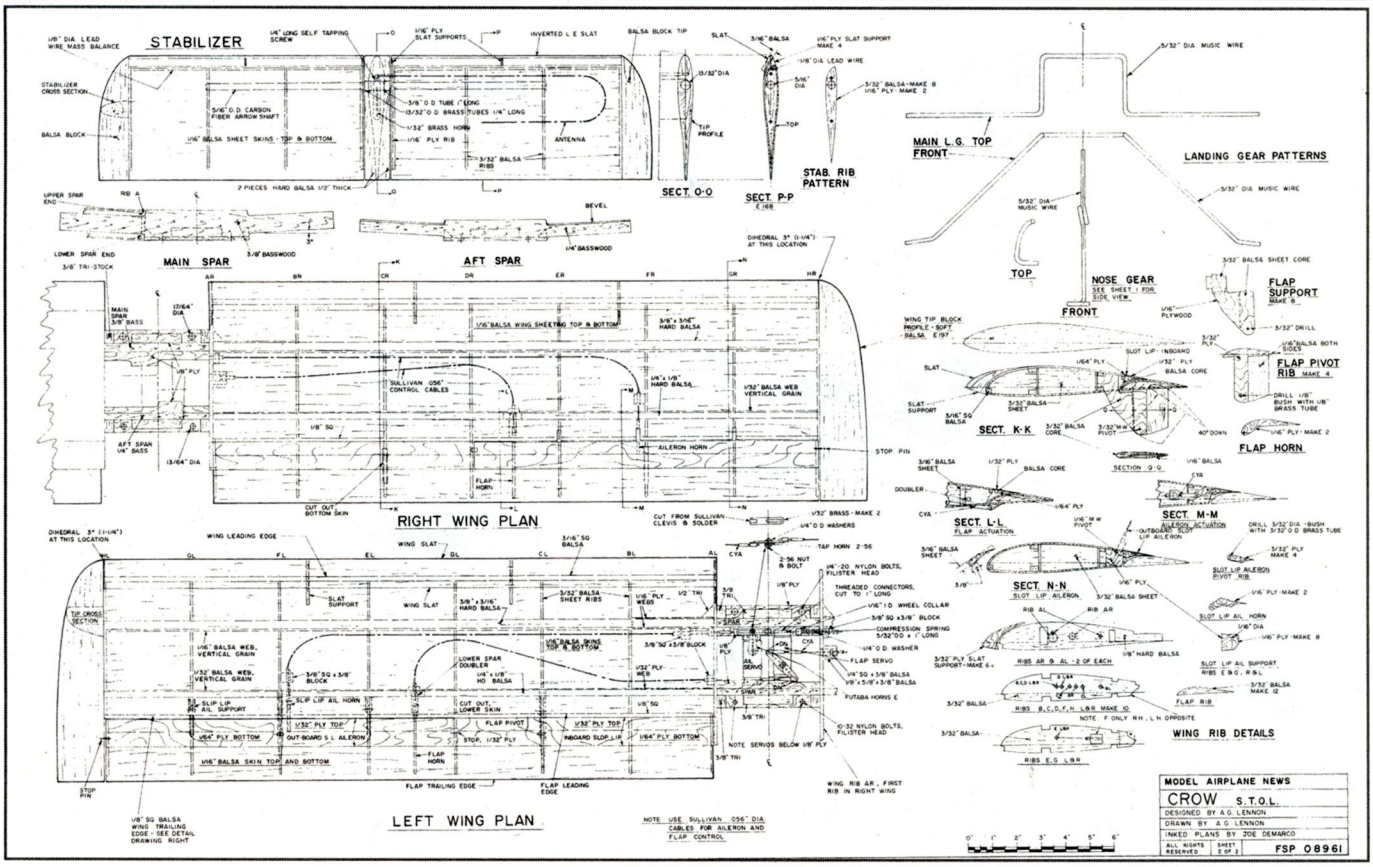
The slot supports have been added and are ready for painting, Hunt's X-Acto® line includes a small spoke shave that's very useful for shaping both slots and fuselage corners.

metal, balsa, or plywood, problems are unlikely. To avoid complications, follow the suggested sub-sub-assembly and sub-assembly procedures in the order in which they are given. It would be difficult to lace the main landing gear to the fuselage's internal structure if the bottom sheeting had been installed.

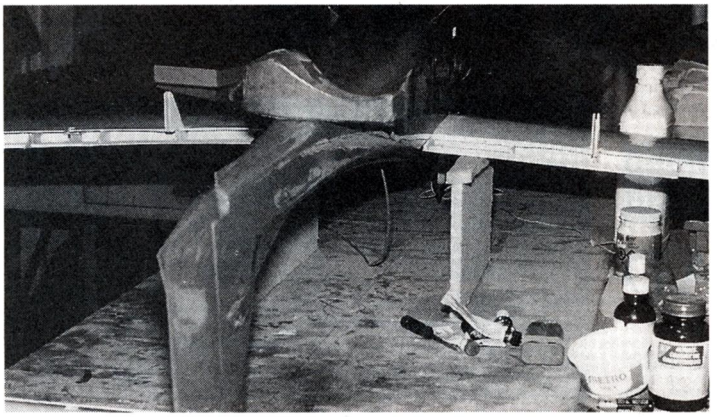
FLYING

With its low weight-to-power ratio and with flaps half-extended, the Crow will leap into the air after a very short takeoff

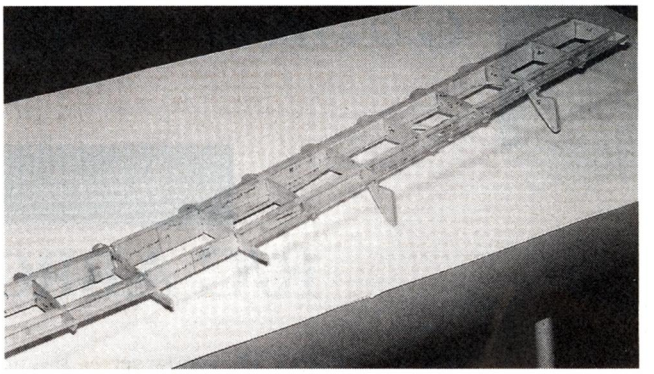




TO ORDER THE FULL-SIZE PLANS, SEE PILOTS' MART.

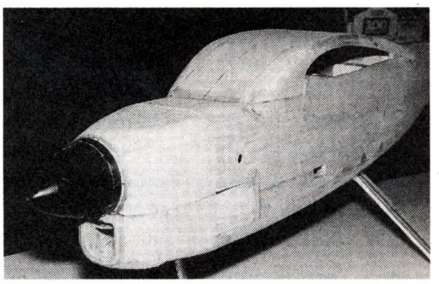


The fixture for the stabilator installation. Before epoxying the fin top to the stab center section, use the cord to pull the antenna through to the receiver box, then connect the clevis and stab horn. Note that the MonoKote* covering has been applied, but the balsa has been left bare where it will be epoxied. Install the inboard slot lips. Securely cement the slot-lip ailerons to the pivot ribs, and align the ailerons with the wing skin.



The completed wing substructure. Sheath anchors, sheaths, webs and the 1/8-inch-square balsa strips that are ahead of inboard slot-lips and outboard slot-lip ailerons have been incorporated.

Check for ease of movement. Install the slotted flaps, and check for smooth operation. Add the block tips.



The shaped cowl and canopy.

The wing is being assembled. The flaps and slot-lip ailerons are used to correctly position their supporting rib sub-assemblies. Note the cable and the flap support (left), which overhangs the edge of the fixture. The sheath anchors have been installed.

run. It will surprise you!

In flight, the controls are normal. The slot lip ailerons are very effective, flaps up but even more effective with the flaps extended. The stabilator is to be treated with respect; it is powerful! Lowering full flaps does not result in any significant pitch change. Landings are slow, nose-high, but because of the flap drag, some power (above idle) is needed in the last few feet of the approach when the model is flying almost parallel with the ground.

Good luck and happy landings!

**Addresses are listed alphabetically in the Index of Manufacturers on page 128.*

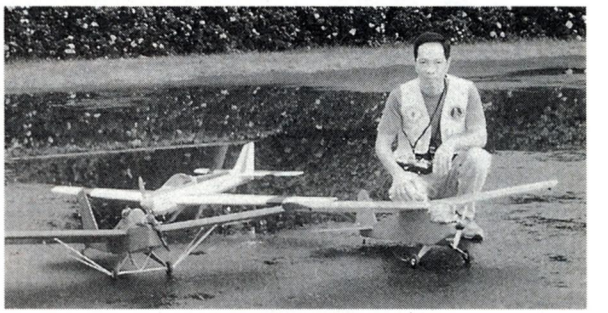
About the author

Quebec, Canada, native Andy Lennon has designed and built more than 25 R/C model airplanes, and he has shared his vast knowledge of model aircraft aerodynamics and design in numerous Model Airplane News articles.

Golden AGE OF R/C

by HAL deBOLT

R/C ABROAD

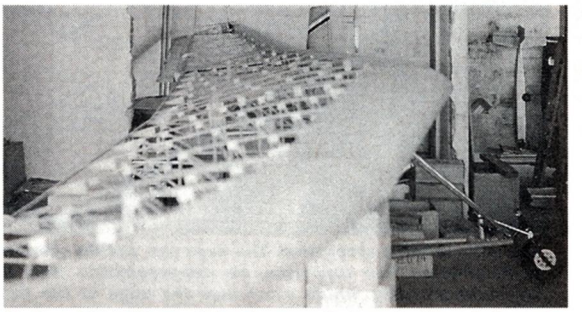


Dr. Reynaldo Cortez enjoys R/C in the Philippines with his LW Super Cub, Chaos and Farmon. He's dedicated to modeling.

R/C IS POPULAR worldwide; we know this from FAI championships. It always interests me to hear what R/C old-timers in other countries are able to tell us about our hobby.

R/C ACROSS THE SEAS

Dr. Reynaldo Cortez of a small Philippines city has described in detail the major effort required to fly R/C in his isolated island republic. All hobby supplies have to be obtained from abroad. Do you need hinges or covering? Delivery will take a month! Income may be minimal, but the cost of supplies is in dollars! You have to be dedicated. Reynaldo apparently learned to fly with a LW trainer. Now he enjoys his LW Cub, Farmon and Chaos and wishes he had a second R/C system. How sweet is it in your town?



Italian OT R/C modeler Isaaco Valero built a 1:1 scale Mitchell Wing. (Just knock out the house wall for clearance!)

Isaaco Vallerugo of Udine, Italy, is a much-traveled modeler who left Italy in the postwar hard times and lived in Argentina for 36 years. There he enjoyed R/C and ultralights. Now back home, he said that R/C is alive and well in Italy. Currently, he enjoys an R/C glider and a Chaos. Like many OT'ers, he believes that giant scale is better suited to his present abilities. He hopes to add a large "Extra" to his collection.

My recent comments on the origin of R/C biplanes brought input from Geoff Goldsmith in England. Geoff added a second wing to an LW Champion bipe; at last it performs as he had hoped. Apparently, the original

IN HIS FATHER'S FOOTSTEPS

Speaking as one who has been associated with *Model Airplane News* since its inception, I believe that the magazine has been at its best whenever its editor has been an accomplished modeler; among these have been Charlie Grant, Bill Winter, Walt Schroder and Art Schroeder.

Editor Gerry Yarrish, who joined *Model Airplane News* in 1990 under the guidance of the respected Tom Atwood, is a fine modeler who has kept the magazine flying high. Gerry, who comes from a modeling family, began flying R/C before high school. Gerry's father, Ed Yarrish, flew in free flight days and progressed into R/C while in the Army in the early 1950s. Ed was a photographer who took photos of the Army brass, including Patton, Eisenhower and Marshall. (Ed passed away in 1977.)

Ed's first R/C system was the English E.D. brand, purchased at Polks. Gerry noted that its escapement cost $40; that was in '50s dollars! The TX used a full-wave, 9-foot antenna; we needed all the power we could get! Gerry recalled that his father's Foxworthy short wave performed exceptionally well.

In 1951, Army photographer Ed Yarrish assembled an LW Kitten while stationed on Governor's Island, NY.

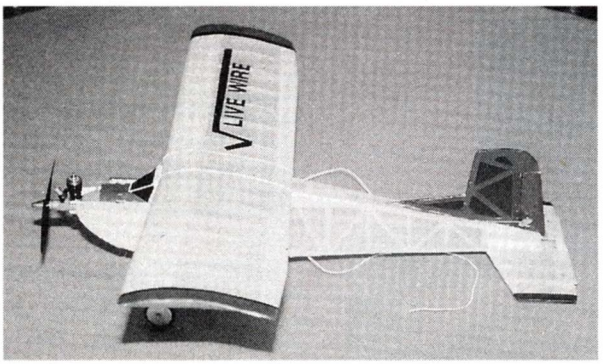
Ed apparently had a penchant for ½A engines and loved the Torpedo and Wasp. Both father and son had a ball with many Goldberg Jr. Falcons. When he progressed into larger sizes, Ed was one of the many who assembled their own systems from the famous Heath kits. Ed also assembled a World Engines Blue Max for Gerry's Enya .29-powered Andrews H-Ray and for his own Fox .78-powered Sterling PT-17.

Happy to say Gerry followed in his father's footsteps and is very active in R/C, with a current interest in giant scale.

Good work, Gerry Yarrish!

Saito .45 power did not suit the 8½-pound Champ, but a switch to an O.S. FS .48 Surpass brought it up to his expectations. (A good question: how are you able to stuff 8½ pounds into a Champ?)

I'm not familiar with the radio Geoff uses, but it's surely an interesting one. In early times, C-S and Babcock had a 465MHz single-channel system; would you believe the UK World Electronics Co. produces a multi-channel propo system *today* on 465MHz? Geoff said it works well; when he wants to fly, he does not have to spend much time waiting for his frequency to clear. Good deal!



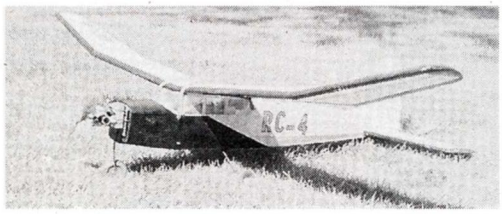
Frank Hasty reduced George Wilson's LW trainer (Model Airplane News December '95) by 50 percent. Now it has a span of 24 inches, it's .02 powered, and it performs nicely.

BOOTSTRAPS

Back in the U.S., Olin Cook of Chateaugay, NY, wrote that he thoroughly enjoys the OT R/C material in *Model Airplane News* and explained that he had success in the early days with an Aerotrol-equipped "Bootstraps"*; he had a ready supply of the XFG-1 tubes, which were short-lived. He plans to relive those experiences with a replica Bootstraps.

Speaking of the Bootstraps, some may recall it as one of Berkeley's first R/C kits; apparently, its designer was the famous free-flighter Henry Struck. Olin said that he really appreciated its removable R/C unit, à la the Live Wire series. In those days, it was an advantage to have the unit removable for maintenance and interchangeability between models. In hopes of getting at least one flight, you took two or more models to the field!

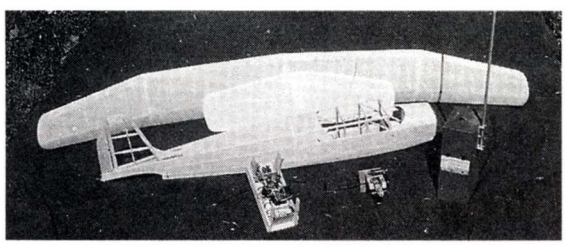
Modelers have often commented on the merits of the LW Champ, but I do not recall the same for the LW trainer. In the December '95 issue of *Model Airplane News,* George Wilson presented his modern, full-size version of the trainer; impressed, Frank Hasty of Brunswick, GA, decided to work on a "minute" R/C model; he reduced the plans to half size—a 24-inch span. Photos show that the result was a lovely "½ trainer," powered by a Cox .02; there was no mention of the lightweight radio required.



Olin Cook's 1952 Berkeley Bootstraps.

Unfortunately, on the first day of flying, the radio failed, and the "Lil Trainer" disappeared into some woods. The search for it came to a sudden halt when his group stumbled onto a 4-foot *rattlesnake*! Frank said that when the rattler's skin finally dries on his workbench, he will build another little trainer.

Frank Hasty's experience reminds us of an idea that John Worth has been promoting in the VR/CS newsletter. It seems that a minute R/C system is available in Europe. Combine this with the now-available, extremely light electric power, and ½-size OT R/C replicas become probable. John mentioned remarkable success with several; he thinks that even indoor flight may be possible!



In those early days, a removable R/C unit was a distinct asset. This one is in Olin Cook's Bootstraps.

YOUTHFUL DREAMS

My discussion of Ed Kazmirski's "Taurus"* brought responses, including this interesting lesson sent in to us by Thomas Titolo of Atascadero, CA.

Tom tells us that, as a very naive 12-year-old, he obtained a copy of *Model Airplane News* with "Kaz" and his Taurus depicted on the cover; Tom immediately fell in love with the plane. Even though he did not have the slightest idea of what was involved with an R/C model of this complexity, he was determined to have one. It took him a year to save the $29.95 for the kit; when it arrived, he quickly began to build. When he read the instructions, he realized that he lacked the experience required for such a project. Fortunately, his parents had seen a news article that mentioned the local club, the Cloud Busters. A phone call to its president brought an invitation to visit. When Tom mentioned that he, a newcomer to modeling, was building a Taurus, the president wisely clued him in as to how far off-base he was. It was advice Tom has never forgotten in his 33 years of modeling!

Later, Tom acquired a "Tri-Squire" that used the Galloping Ghost system, and he became a successful R/C'er. When Tom's family moved to California, he ventured to "Mile Square," where Louie Ziniker was promoting R/C by letting onlookers try his propo model. After 15 minutes of flying, Tom was in heaven! With Louie's help, Tom finally realized his childhood dream of building the Bonner propo-guided Taurus with Kaz's color scheme.

Although a disability forced Tom to dissolve his successful construction business, his persistence compelled him to found Pro Flight Products, whose objective is to produce model kits. Tom spent over a year designing and modifying machinery so that he could mill balsa despite his handicap. Now he is setting up to produce his first kit.

And so it was with you all.

**Addresses are listed alphabetically in the Index of Manufacturers on page 128.* ✦

MODEL AIRPLANE NEWS

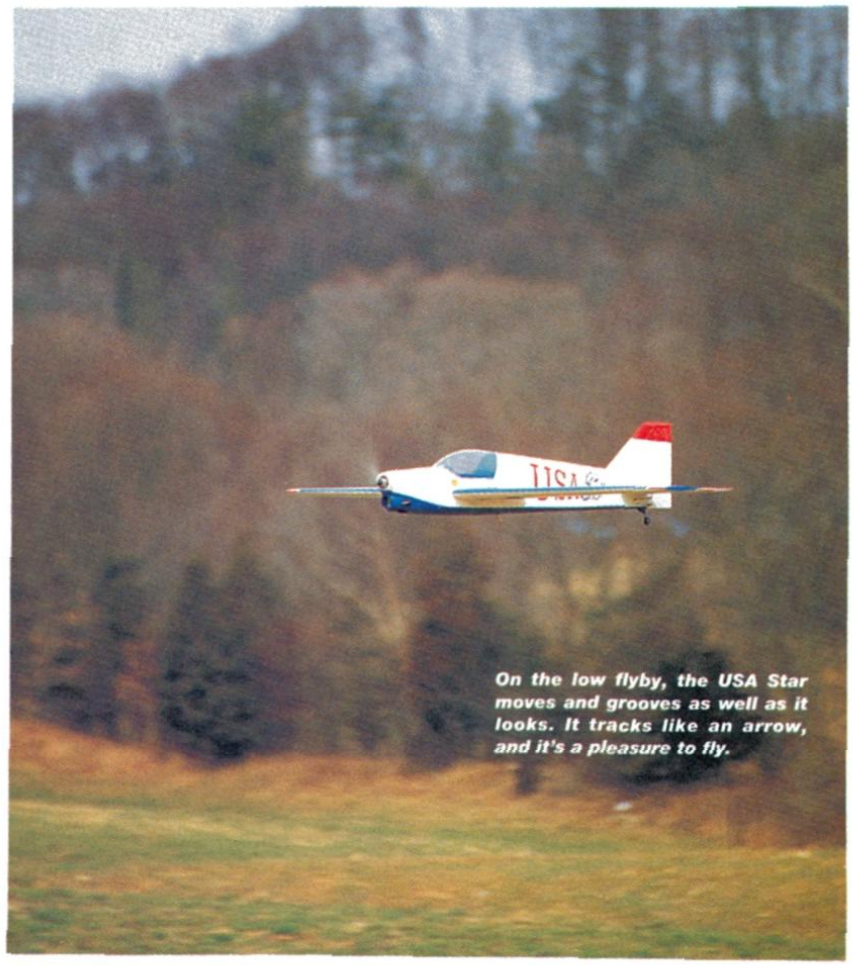
FIELD & BENCH REVIEW

Precision aerobatics for pattern fliers

DIRECT CONNECTION R/C

USA STAR

by DAVID MILES



On the low flyby, the USA Star moves and grooves as well as it looks. It tracks like an arrow, and it's a pleasure to fly.

John Mangold holds the USA Star while I make a gear adjustment.

The K&B paints on the fuse, along with the red, white and blue MonoKote on the wings, make the model very visible in the sky. There's no question about the plane's attitude when it's airborne.

PHOTOS BY WALTER SIDAS & DAVID MILES

THE DIRECT CONNECTION R/C* USA Star is a thoroughbred pattern plane designed to meet all F3A pattern competition requirements. Designed by national champion Dave von Linsowe, this large, lightweight ship is for competitive flying. Although the USA Star is not for the faint of heart, sport fliers, too, can enjoy its clean lines and nimble aerobatic performance. Be prepared to spend some money for the equipment required to complete this project, but the return on your investment will be a top-of-the-line performance plane that is exciting to fly.

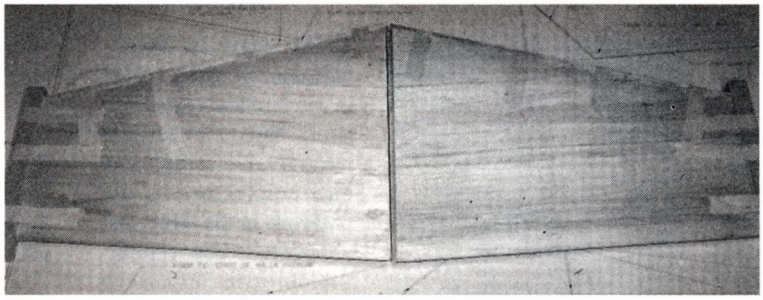
THE KIT

This kit is complete; it includes full-size rolled plans, balsa and plywood parts, all the necessary hardware to finish the plane (including pushrods, screws and a high-quality vibration-isolating engine mount), instructions, carbon-fiber mat material and foam-core wings and stabilizers. The quality of all components is first-class. The sheet balsa is competition-grade. All plywood parts are band-sawed and accurately sanded, and the foam-cores are perfectly cut, clean and true.

CONSTRUCTION

• **Wing and tail surface.** The wing and horizontal and vertical stabilizers are constructed of foam-cores covered by 1/16-inch balsa sheeting.

The first step was to lay out the horizontal stabs' 1/16-inch-thick sheeting with the grain running in the proper direction. I laid out the balsa sheeting over the plans (covered with wax paper), and marked it according to the plans, one plank at a time. To hold the planks firmly together, I used masking tape



Here's the completed horizontal stab with the tip blocks added. All the control surfaces' trailing edges are carbon-fiber rods, which strengthen their thin edges.

and then glued the planks together with thin CA. Next, I sanded the sheeting smooth so that all the glue joints were flush.

I used Zap* two-part epoxy to laminate the sheeting to the foam-cores. I spread the epoxy onto the balsa sheeting with a squeegee made of a piece of 1/32-inch-thick plywood with slots cut in it every 1/2 inch. This left epoxy ridges on the balsa and provided an ample glue joint without adding weight.

I lined up the sheeting with the cores and placed them into their original foam cradles. I placed the foam cradles on a flat table, covered them with a flat board and added approximately 30 pounds of weight. I let this dry for 24 hours.

Next, I joined the two halves of the horizontal stab and cut out the elevators with a band saw. I added the leading and trailing edges to the stabilizer and elevator halves and sanded all the parts. The thin trailing edges of all flying surfaces are strengthened with durable carbon-fiber rods.

I built the vertical stabilizer and wings in the same way. Before I sheeted the wings, I cut out the landing-gear blocks and servo-mounting hard points. When I glued the sheeting to these foam surfaces, the rudder needed approximately 10 pounds of hold-down weight while the wings required closer to 90 pounds.

When this epoxy had dried, I added the leading edges, trailing edges and balsa tip blocks and did the final sanding and shaping on all the flying surfaces. I set the wings and stabilizers aside until final assembly.

SPECIFICATIONS

Model: USA Star

Type: F3A pattern plane

Manufacturer: Direct Connection R/C

Wingspan: 73 in.

Wing area: 1,095 sq. in.

Weight: 8 lb., 12 oz.

Wing loading: 18.42 oz. per sq. ft.

Airfoil type: symmetrical

Length: 76 in.

Engine used: YS 1.20 air chamber with Hatori pipe and header

Prop used: APC 15x10 pattern prop

Retracts: Dave Brown* mechanical

Configuration: tail dragger

Radio used: JR 388S PCM

Servos: four JR 4131 (two for ailerons; two for elevator, rudder) one JR 341 micro, one Futaba retract servo

List price: $345

Features: full-size rolled plans; excellent quality, band-sawed and hand-sanded balsa and plywood parts; foam-core wings, horizontal and vertical surfaces; heavy-duty carbon-fiber mat; complete hardware package; instruction manual; and great looks that are matched with great flying characteristics.

Comments: after seeking help with the fiberglassing, I found the USA Star an easy plane to build and a dream to fly. Since its completion, I've been flying mine every chance I get, and my enjoyment of it continues to grow.

Hits

- High-quality wood and parts in the kit.
- Clear instructions and plans.
- Clean lines and a great flying machine.
- Isolation engine mounts.

Misses

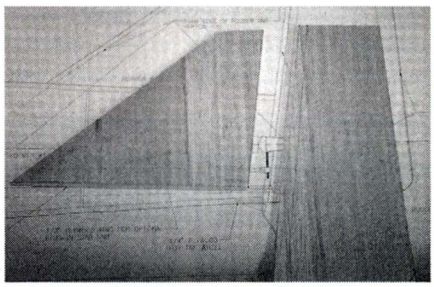
- The guide for labeling the vertical and horizontal centerlines on the fuselage formers was difficult to use because the parts didn't match exactly. This was corrected in subsequent kits.

• **Fuselage.** I began by labeling the parts of the fuse; this is the only spot where I found an inconsistency. The guide for labeling the vertical and horizontal centerlines on the fuselage formers was difficult to use because the parts didn't match exactly. Direct Connection sent me a revised guide that has since been included in all kits.

The fuselage is basically a six-sided structure that consists of formers, sheeting and planking. The inside is strengthened with an overlay of carbon-fiber mat that is attached with either CA or epoxy. The turtle deck is the only section of sheeting that isn't flat, and it requires that the balsa sheeting be curved around the formers. To easily bend the sheeting for the turtle deck, I soaked it in ammonia.

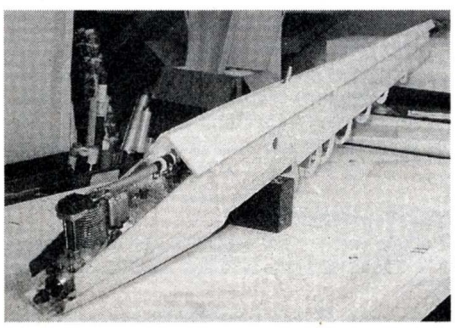
I chose not to have a removable hatch to access the tuned pipe, so I had to install the pipe before I completed the fuselage.

After I had finished the fuse's main body, I installed all the necessary servo mounts, engine mounts and hardware. Then, I shaped and sanded the fuselage with a razor plane and a sanding block.



The vertical fin and rudder sheeting is shown just before its application to the foam-cores. After the sheeting has been glued into place, balsa tip blocks and carbon-fiber rods will be added to the edges.

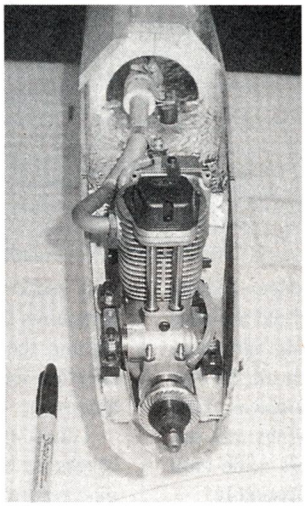
• **Final assembly.** When I attached the vertical fin, I was meticulous because I wanted to ensure proper alignment. Next, I installed the wing-rod doublers in the fuselage and installed the wing-root ribs and anti-rotation pins in the wings. To align the wings with the fuselage, I drew a centerline for wing incidence on the outside of each fuselage side and drilled the mounting holes for the anti-rotation pins. I trial-fitted the wings to the fuselage and checked them with a wing-incidence meter. When they were correct, I locked them down and installed the horizontal stabilizer on the



I've just finished gluing on the bottom sheeting, and I've used masking tape to hold it in place. With a razor plane, shaping the fuselage was quite easy.

fuselage. After zeroing the stab and wing incidences, I glued the stab into place.

I covered the fuselage with K&B* light fiberglass and Zap finishing resin. I painted the fuselage with K&B primer, then I sanded and finished it with coats of white and blue K&B epoxy paint, and I covered the wings with MonoKote*.



The engine has a right-thrust offset that will help counteract torque. The Hatori tuned pipe was iso-mounted, just like the engine. This really helped to cut down the dB level.

• **Radio and engine installation.** The guidance system for my USA Star is a JR* 338S, four 4131 coreless servos, one 341 microservo and a Futaba* retract servo. The rudder and elevator servos are in the rear of the fuselage, behind the wing's trailing edge. They provide control inputs via a pull/pull system and a Y-connector pushrod, respectively. The retract and throttle servos are directly between the wing halves in the fuselage center section. The mechanical retracts are attached with ball connectors to the pushrods in the wing, and a push/pull cable controls the throttle. For each aileron, the wing has one servo that is attached to a short pushrod.

To eliminate all slop from the controls, I was extremely careful with the control-surface setup. This plane is fast, so I wanted to eliminate any possibility of flutter.

To power the plane, I used a YS* 1.20 4-stroke with an air chamber and a Hatori* tuned pipe. This combination, along with an APC* 15x10 propeller, provided plenty of power and vertical performance with a sound reading of 88dB. Incredibly quiet!

IN CLOSING

The USA Star is easy to build if you have a little knowledge about fiberglassing and incidence setup. The instructions and plans are clear and easy to follow, and the result is a beautiful pattern plane that is quite slick in the air. I'm sure you'll enjoy yours as much as I enjoyed mine, so pick one up and get started. Those F3A competitions are calling you.

**Addresses are listed alphabetically in the Index of Manufacturers on page 128.*

About the author

Dave Miles has been flying R/C aircraft since 1985. He has built about 50 planes in his R/C career, and over the last few years, he has taken a real interest in helicopters. He's currently the secretary of his R/C club, and he also enjoys skiing and target shooting.

FLIGHT PERFORMANCE

My first flight with the USA Star occurred in less than ideal conditions. But I was extremely motivated, and I was not going to allow 20mph gusts and cloudy weather to come between me and the enjoyment of the fruits of my labor.

• Takeoff and landing

For the first flight, I enlisted the help of my longtime friend, Dave Baron. After test running the engine and checking throttle response and idle, we carried the plane out to the runway. Depending on the field, the USA Star may require full up-elevator during taxiing and at the beginning of takeoff roll. Once the plane is accelerating, ease off the up-elevator so that the plane won't leap into the air. The Star required only a little right rudder on the takeoff roll. When the plane lifts off, maintain a constant climb and retract the landing gear. When the gear retracts, the plane needs a little down-trim to stay level.

Landing the USA Star is very comfortable. Its clean design does not provide much drag for slowing down, so I extend my landing gear prior to entering the pattern. I also bring the trim back slightly on my idle and use the windmilling prop for additional drag. I then set up a long, shallow approach to bleed off any additional airspeed. The Star has a tremendous speed range, and you can virtually walk it onto the runway. The controls remain crisp throughout the speed range, and I have not had any problems with tip-stalling. Until I was used to landing the Star, I tended to overshoot the landings. The Star has a nice glide, so take this into account when you set up a final approach.

• High-speed performance

This is where the USA Star really comes alive. It can climb out of sight vertically, and it tracks straight through all attitudes. The controls are crisp and immediate, and there is no tendency toward high-speed stalls.

• Low-speed performance

The Star's controls remain responsive right up to the stall. Stalls are gentle, and the nose drops straight forward. With a slight addition of throttle, recovery is virtually instantaneous. It's very comfortable to fly slow, lazy patterns with the Star, but I doubt that you will want to.

• Aerobatics

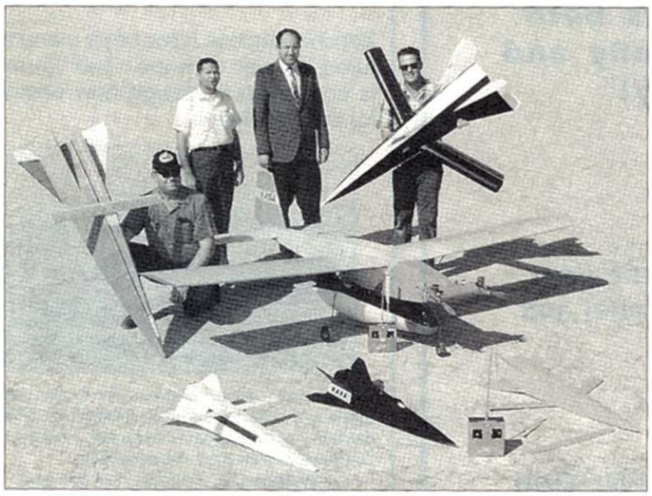
This is what it's all about. The Star was designed to perform the turnaround patterns flawlessly, and it does. It tracks gracefully at all angles; rolls are axial, and trim remains neutral in climbs and throttle-on or -off dives. Loops are big and graceful and require a little right rudder to keep the tracking straight. Snap-roll entries and exits are crisp, and the rudder has plenty of authority to maintain a knife-edge attitude indefinitely. The Star showed no tendency to roll-couple when placed in a knife-edge attitude. Slow rolls are graceful, and altitude is easily maintained with a light stick pressure on both the elevator and rudder. Inverted flight requires only slight forward elevator pressure, and spin entry takes some getting used to because the plane will appear to be completely stopped though it's still flying. To enter a spin, I found it necessary to pull the elevator stick all the way back. Once in a spin, neutralize the controls, and the plane will stop its autorotation immediately. Perhaps the most majestic maneuver that the Star performs is the hammerhead. As the plane goes vertical, pull back the throttle, and wait for it to stop climbing. Just as it appears to stop, I kick the rudder; the rudder's size provides plenty of clout to rotate the plane on its vertical axis.

Flying the USA Star is a real pleasure, and I'm sure you'll find that your pattern flying will improve with this graceful bird. It's definitely not a beginner or intermediate plane, but an experienced pattern flier will have a ball.

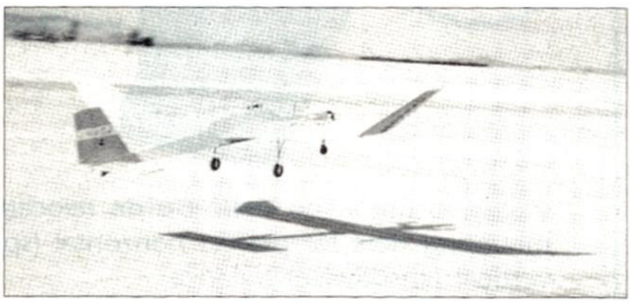
An R/C test model with a long and interesting history

NASA's Mothership

by DAVID B. EICHSTEDT

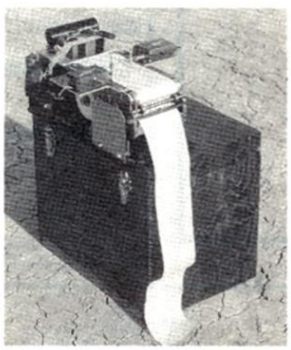


The NASA Mothership model and the test crew for the Hyper III flight program. Left to right: Jim Newman, Dick Eldredge (Mothership's builder), Dale Reed (designer and project manager) and Bob McDonald.



Mothership takes to the sky. Without a load, it will lift off in about 3 feet with a slight headwind. (Photo by Dale Reed.)

WHEN CHUCK YEAGER flew the Bell X-1 on its first supersonic flight, he made history, but that flight couldn't have happened without one important tool: the B-29 that carried the X-1 aloft. When Scott Crossfield and Milt Thompson were touching the edge of space in the X-15, their record-setting flights couldn't have been made without the NASA B-52 mothership. These feats of aeronautical heroism are well-known throughout aviation circles. Many people don't know, however, that several of these exciting projects of the '60s and '70s began with R/C research models. Just as the lifting bodies and the X-15 couldn't have made history without the B-52, most of the lifting-body models couldn't have flown without a large, easy-to-fly model known simply and affectionately as "Mothership."



This primitive "downlink" telemetry recording device used in the late '60s consisted of a second receiver on the same channel as the one on the Mothership and two servos that measured, plotted and recorded control inputs during test flights. A very simple, but useful engineering tool.

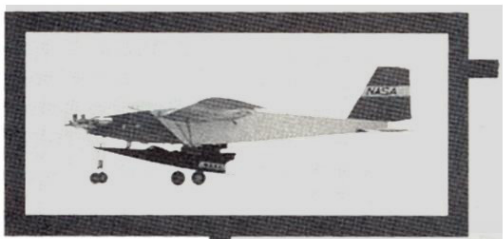
HISTORY

Conceived and designed by NASA project manager R. Dale Reed and built by Dick Eldredge, the Mothership model was completed in 1968. It was made of balsa and plywood with a silk and dope finish. The only unique aspect of the aircraft was its weight-saving, built-up wing ribs. The horizontal tail bore a striking resemblance to the Carl Goldberg Models'* Falcon 56 wing. Mothership's original wingspan was 10 feet, and power was provided by two SuperTigre* .60s. Later, it was flown with twin K&B* .61s, and finally with two O.S.* .61 FSRs.

MOTHER'S MISSION

Mothership was designed to carry and drop small, unconventional R/C models. Most of these "drop" models were designed as re-entry vehicles that could return from space and make a horizontal landing on a runway. Beginning in late 1968, the Hyper III and M2-F-2 models shown in the photos were among the first to be dropped from the Mothership. In addition to serving as a drop platform, Mothership has been used as a test bed for different experimental guidance and control systems. Among these were various versions of electrostatic, pressure-static and solar-powered systems.

Throughout the years, Mothership has been a stable and versatile platform. Two major modifications were made: in 1983, a modeler was hired to build a set of 2-foot wingtip extensions. The testing of a classified vehicle was to be conducted at a small, but secure, lakebed at Edwards AFB. Mothership needed to take off and land in a short distance and fly more slowly than usual. Adding the



Here are some photos of an actual test flight during the Hyper III project. The concept of a lifting-body vehicle suspended under a flying canopy has been revived with the new X-CRV project.

R. Dale Reed (left) designer of Mothership, poses with author at Sofranic's Ranch—a private dirt strip in Lancaster, CA.

PHOTOS COURTESY OF NASA

SPECIFICATIONS

Wingspan: 10 ft. without tips, (14 ft. with extended tips)

Chord: 20 in.

Length: 108 in.

Engines: two O.S. .61 FSRs with muffled tuned pipes

Props: 14-inch APC*

Radio: Futaba* 9VAP (original radio was a PCS built by Kraft)

Weight: 22 to 25 lb. (dry)

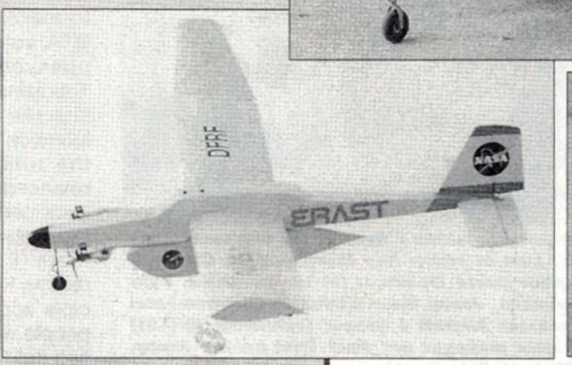
Fuel capacity: 40 oz.

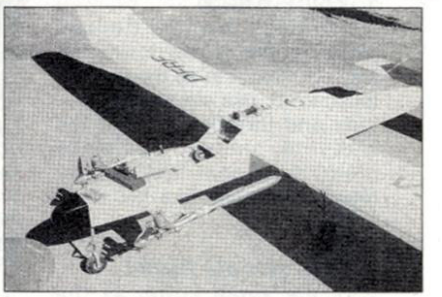
Endurance: 20 to 45 min.

No. of channels: 4 to 7 (rudder, throttle, aileron and elevator; extra channels used for specific tasks)

Airfoil: Wortman FX 61-163

Comments: the Mothership was built by NASA as a multipurpose R/C platform used to test models of proposed reentry vehicles. It has undergone many structural modifications. The original wing used built-up ribs and was covered with silk and dope. It has since been reinforced with carbon fiber and covered with MonoKote.





Here is the updated Mothership with nose and wingtip extensions attached. The two engines have 6 degrees of downthrust, and the short rubber-ducky antenna is for a video downlink. Mounted on top of the fuselage are a video camera and a GPS antenna. (Photo by Dale Reed.)

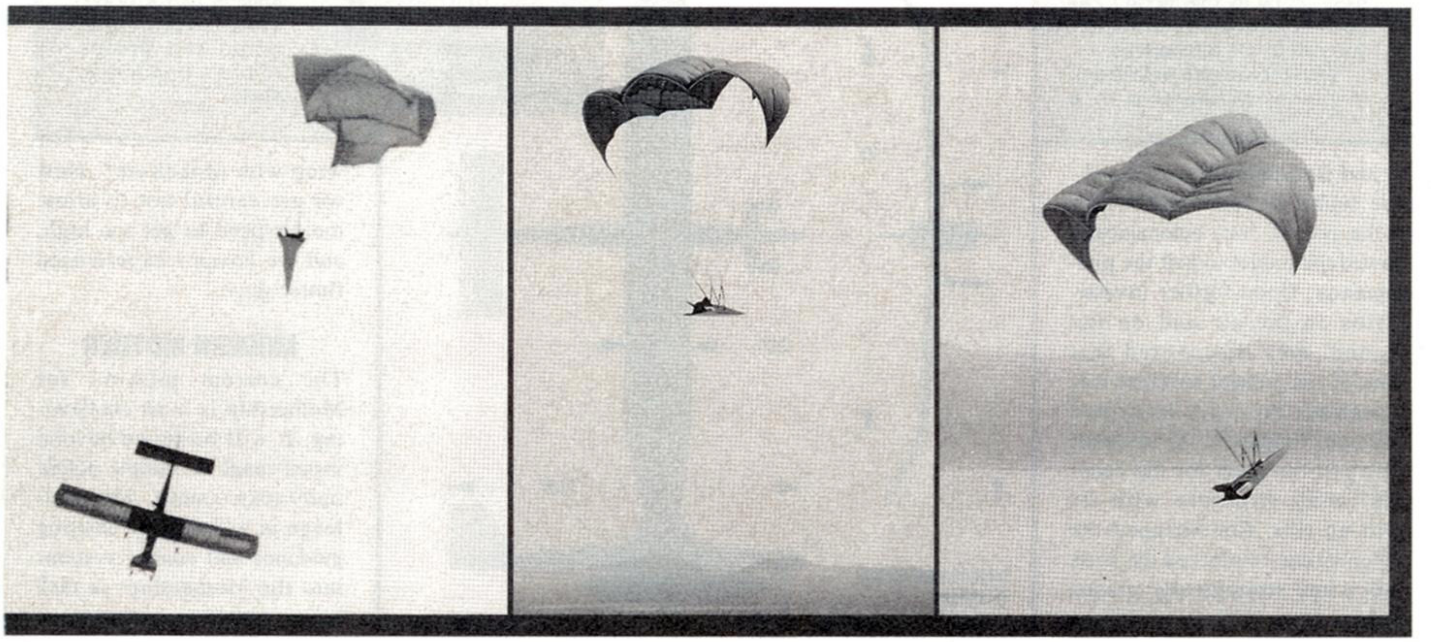
wingtips enabled it to complete the mission safely. The wingtips also increased the weight-carrying capability and increased lateral stability, giving it the ability to fly "rudder-only."

In 1990, another classified vehicle was dropped from Mothership. This vehicle was too long to fit under the Mothership,

Jim Newman (left) and Bob McDonald load an M2-F2 test model onto the Mothership.

so Ron Gilman lengthened the nose to accommodate the new payload. The engines were lowered, the nose gear was moved forward, and to facilitate installation of cameras or instrumentation, the nose cap was redesigned to be removable.

On a mission during this project, pattern flier Jerry Budd was at the controls when



FLIGHT PERFORMANCE

• Takeoff and landing

Takeoffs and landings are nearly identical with the tips removed or installed. Taxi out, steer into the wind, apply throttle, and feed in a little up-elevator to get Mothership to rotate and lift off. Full throttle isn't necessary for takeoff unless you're heavily loaded or want to get off the ground quickly. In most flight regimes, twin-piped O.S. .61 FSRs are too much power for Mothership! Warning: immediately after liftoff, be prepared to release back pressure or even feed in some down-elevator, because at high-throttle settings, Mothership has a tendency to pitch up. To reduce this effect, once off, I usually reduce power to about two thirds.

Landings are fun. Reduce power to idle on the downwind, and just float it in all the way. At touchdown, use elevator for attitude and throttle to arrest the sink rate, and you can make pretty main-gear-first, greasy touchdowns just like full-scale aircraft.

Mothership makes a flyby as the test team looks on. Left to right: Ray Morgan, Ken Carbine, author David Eichstedt (at the controls), Kyle Swanson, Jenny Baer-Riedhart—Environmental Research Aircraft & Sensor Technology (ERAST) project manager and Paul Trist behind Jenny. (Photo by Dale Reed.)

• Low-speed flight

With the same airfoil as the Schweitzer 1-36 glider, Mothership can really hang in there at slow speeds. Control effectiveness is superb all the way to stall, especially on rudder. The model must be forced to stall, and when it does, it's a clean, straight-ahead break. During recovery, power is reduced, and the model is pulled out gently to avoid overstressing the wing. I've never performed a "mushy" stall with Mothership, but it's not intended to fly there, anyway.

• Handling

Without the extended wingtips, Mothership handles like a big trainer with a symmetrical airfoil. Mothership is stable, but not as self-righting as most trainers. It tends to go where you point it. Still, Mothership is easy to fly in this configuration. If you can fly a trainer, you can fly the Mothership.

With the wingtip extensions in place, Mothership is a pussycat. It flies more slowly, and lateral stability is greatly enhanced. Vast amounts of rudder are required to coordinate turns, which are performed electronically, of course. Rudder works so well, in fact, that we often tape the ailerons to the wing and fly rudder-only.

Ken Carbine holds the Mothership during an engine run-up test. That day's mission was to evaluate the guidance and control system used in the Pointer UAV. (Photo by Dale Reed.)

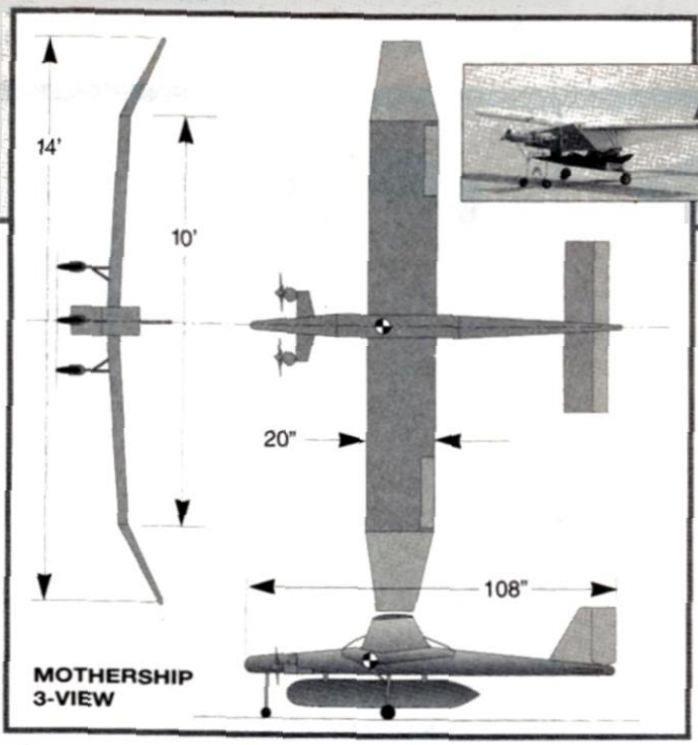
An interesting feature of Mothership is the use of a BTA autopilot to make the model easier to fly. With the BTA autopilot and the wingtips on, the pussycat turns into a pussycat on Thorazine! Without the autopilot, Mothership flies like any other model. Give a right- or left-stick input, and the model rolls. To stop the rolling motion, the stick must be released. With the autopilot, right or left stick commands a turn rate. To turn right, input about one half right stick, and hold it there. Release the stick, and the model returns to straight and level. The same principle applies to up and down. I think more people will start using this system once they find out how well it works.

• Engine-out flight

In either configuration, Mothership does very well on one engine. It can even perform an entire drop mission on one engine if the payload is light. Provided you have enough high-rate rudder, turns can be performed in either direction without fear of doing the P-38 spiral of death. If you don't have enough high-rate rudder, the model will only turn into a dead engine at high power. In this case, simply reduce power to turn into the live engine. Just keep your wits about you, and you'll be fine.

• Deadstick flight

In the unlikely event that both engines quit, the challenge is to keep from going too long rather than trying to make the runway. Mothership is like a powered glider that floats and floats. Avoid deadstick stalls.



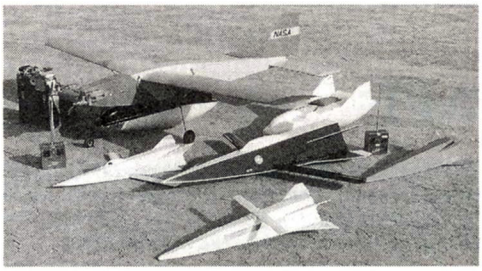
MOTHERSHIP 3-VIEW

he and Ron heard the unmistakable sound of flutter somewhere on the aircraft. Jerry automatically slowed the model to halt the phenomenon. Upon further investigation in the air and on the ground, they discovered that none of the control surfaces was fluttering; the *wing itself* had fluttered! Evidently, the air loads were just too great for the beautiful wing structure with its built-up ribs. Ron stripped the old covering, reinforced the wing with some strategically placed carbon fiber and covered the wing with MonoKote*. Now we are careful not to allow the airspeed to get too high, and we haven't experienced flutter since.

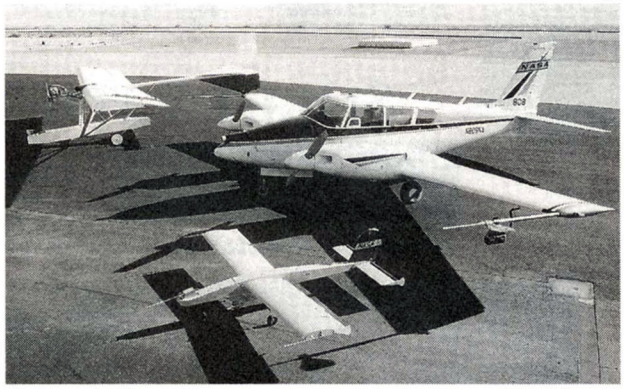
MODERN MOTHER

The current mission for Mothership is most challenging. It will be flown beyond visual range to sample potentially toxic smoke. The challenge is to integrate existing guidance and control systems into the Mothership—a task not as simple as it may seem.

The current mission for Mothership is most challenging. It will be flown beyond visual range to sample potentially toxic smoke.



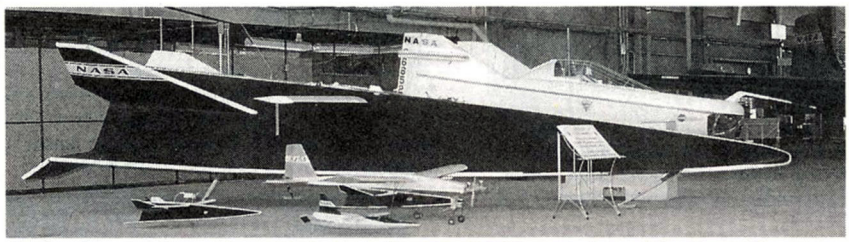
Mothership with some of her small chicks. The drop models in the foreground show four configurations of the Hyper III design. Also shown attached to the Mothership is the M2-F2—a model of the famous lifting-body design aircraft that was featured in the crash footage at the beginning of the TV series "The Six Million Dollar Man."



Mothership (foreground) cleared the way for these other aircraft used in tests for an experimental flight-control system.

Global Positioning System's (GPS) navigational hardware can be coupled with an autopilot system and an onboard video downlink. Because of time constraints, to keep things simple, we may just fly the model with the aid of long-range cameras—a task that's surprisingly like playing a video game. As of this writing, the details have not been settled.

For the researcher, Mothership is a big, simple, versatile tool for advancing the science of flight. For the modeler, it would be a great club airplane. It could be used for candy drops, skydiver drops, glider tows, glider piggyback launches, Bell X-1 reenactments, or as a club trainer, especially with the BTA* autopilot. If you're a dedicated scratch-builder, you should be able to convert the supplied three-view into a flyable airplane. If you do, be sure to send a photo to *Model Airplane News*. We would love to see what you come up with! Until then, 5, 4, 3, 2, 1—DROP!



Mothership and Hyper III models in front of a full-size flying mockup of the Hyper III re-entry vehicle. In the background is the M2-F1—the first man-carrying, lifting-body test aircraft.

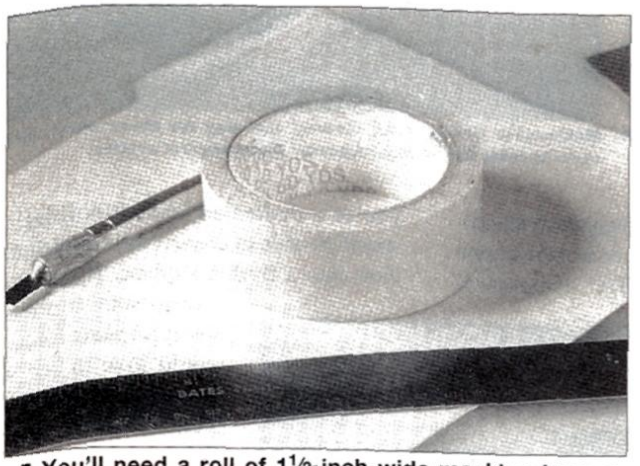
**Addresses are listed alphabetically in the Index of Manufacturers on page 128.*

How TO:

SHEET WITH TAPE

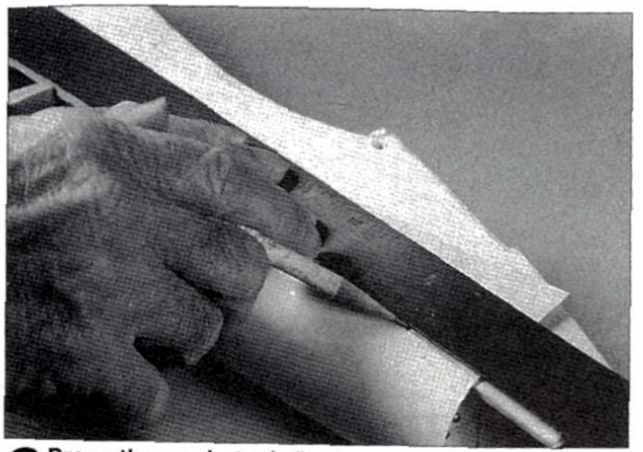
by RANDY RANDOLPH

IT CAN BE FRUSTRATING to apply sheeting around turtledeck formers and other curved surfaces. Instant cement and rubber bands work well, but to hold the sheeting, an additional hand or two is always welcome. The pictures show how to eliminate most of the job's frustration by using masking tape as the third or even fourth hand!

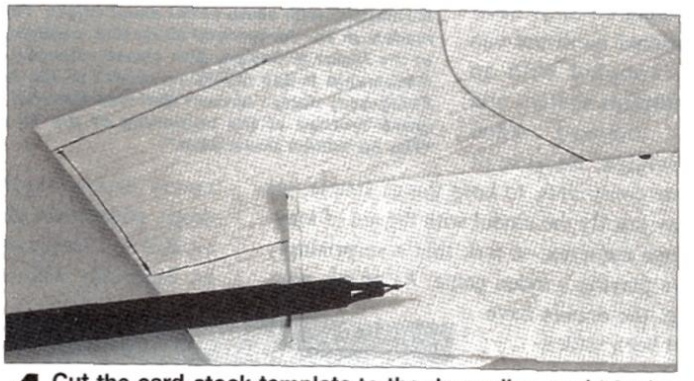


1 You'll need a roll of 1½-inch-wide masking tape, a flexible ruler, a modeling knife and some stiff paper, such as card stock or a file folder. Scissors are handy but not necessary.

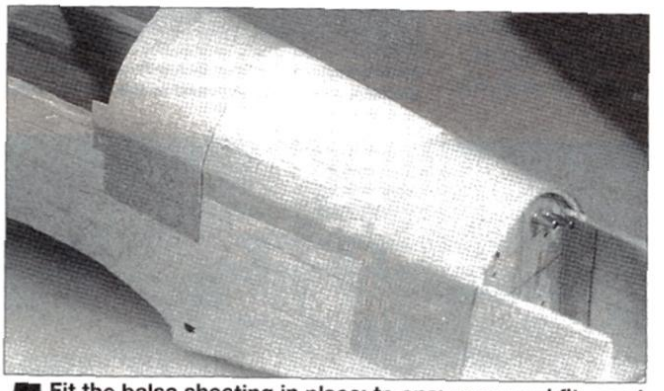
2 To apply sheeting to a straight taper such as a turtledeck, cut card stock to length, tape it to one side of the fuselage, and curve it over the formers to the other side.



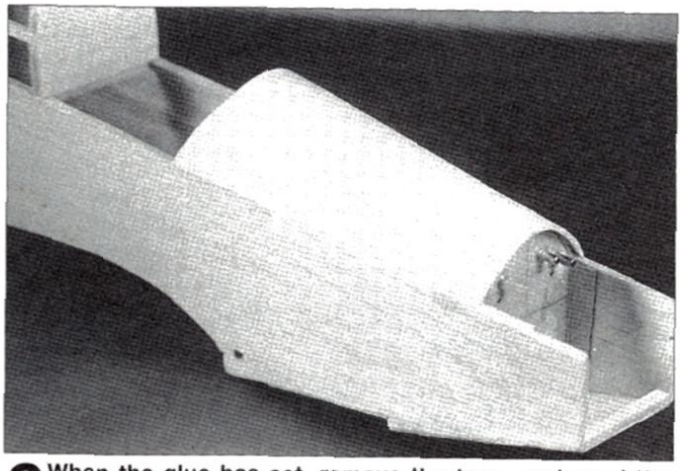
3 Press the card stock firmly over the formers; use a straightedge to mark the card stock on the other side of the fuselage along the line where the card stock makes contact with the fuselage. You'll use this template to mark the balsa sheet.



4 Cut the card-stock template to the drawn line, and trim its ends to correspond to the firewall, cockpit or other former to which the balsa will be applied. In this case, the sheeting goes between the firewall and an open cockpit. Use the template to cut and mark the balsa sheeting.



5 Fit the balsa sheeting in place; to ensure a good fit, sand its edges lightly, if necessary. Apply an aliphatic-resin *glue or a slow CA to the fuse*lage sides and formers. Tape the sheeting to one side, then *curve it over to the other side* and tape it in place. To hold the sheet tightly against the formers, apply additional tape over the ends.



6 When the glue has set, remove the tape, and sand the joints where necessary. If there are compound curves in the area to be sheeted, work between each former, then blend the curves with a sanding block. ✚

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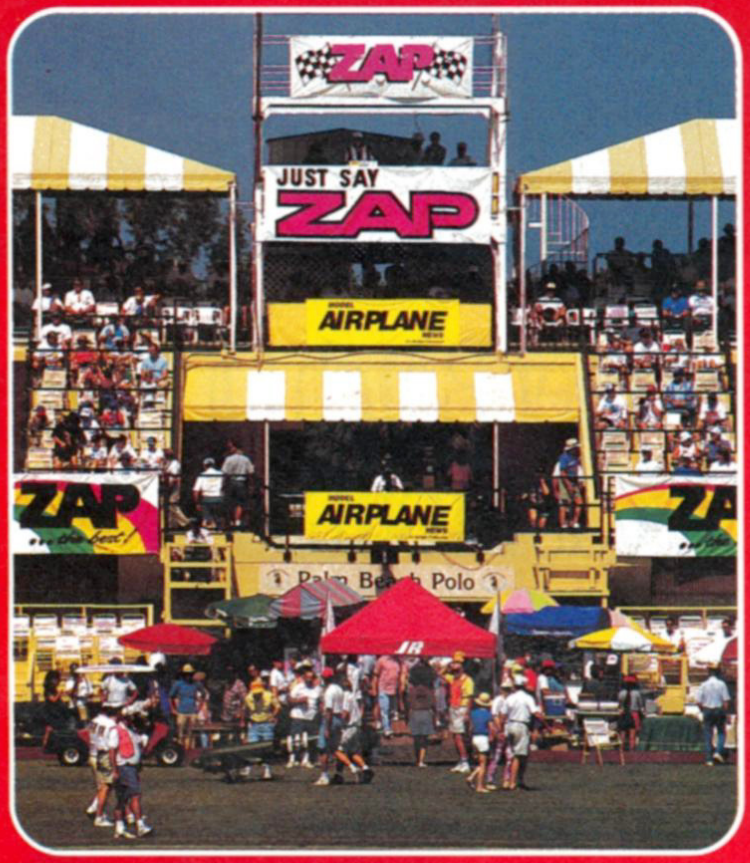


TOP GUN

The best in scale competition

David Hayes—second in Expert; scratch-built, 1/7-scale Ayres Thrush; 82 in. span; 14 lb.; O.S. .91 4-stroke; balsa; fiberglass canopy assembly; Zap adhesives; SuperPoxy finish; JR X-347 radio, operating flaps and crop-dusting equipment.

Jeff Foley—third in Expert; JMP kit; 1/6-scale Lockheed T-33A; 85 in. span; O.S. .91; Dynamax fan; Zap; K&B epoxy paint; JR PCM-10; JMP retracts.

PHOTOS BY WALTER SIDAS & GERRY YARRISH

by GERRY YARRISH

HELD IN FLORIDA at the fabulous West Palm Beach (WPB) polo grounds, Top Gun '96 brought together 62 contestants from the U.S., Canada, Germany, Venezuela and Brazil. The challenge? Becoming *the* Top Gun.

The April 25 to 28 event was the eighth scale invitational and the sixth held in Florida. With thousands of dollars in prize money, Top Gun has a larger purse than any other scale competition in the world. *Model Airplane News* and Pacer Technology* were again the main sponsors, and it's always a privilege to be associated with such a well-organized event.

The putting-green-smooth polo grounds are the perfect setting, food was plentiful, R/C vendors were there in force (in a large, air-conditioned tent), and there was ample seating for the thousands of spectators. Seldom

Greg Hahn—sixth in Expert; Ziroli plans; North American B-25J-1 Mitchell bomber; 118 in. span; 43 lb.; balsa and plywood; twin Zenoah G-38 gas engines; fiberglass cloth and Z-Poxy; automotive acrylic lacquer paint; JR PCM 10SX; Robart retracts, Glennis brakes, bomb-bay doors and six bombs, lights, flaps, interior and exterior detailing.

Charlie Chambers—Best in Military, Craftsmanship and 2-stroke Glow-Engine Performance; fourth in Expert; Don Smith plans; 1/6-scale P-61 Black Widow; 99 in. span; 70 in. long; 38 lb.; balsa and plywood; Zap; K&B glass cloth and paint; Pro Mark markings; two Webra 1.20s, JR PCM 10SX; flaps, retracts, lights, spoilers, tank drop.

Jack Diaz (Caracas, Venezuela)—Best Multi-Engine Performance; BVM kit; F-4 Phantom jet; 59 in. span; 86 in. long; 25 lb.; scale, clean-wing configuration; fiberglass, carbon fiber and foam; K&B and clear PPG paint; two BVM .91 engines with Viojett fans; BVM retracts and wheels. The engines have independent (but mixed) throttle control and independent mixture control, which is also mixed with the throttle channel.

do you find such a spectacular showcase of world-class scale masterpieces all in one place, but at Top Gun, this is the rule and not the exception.

WHAT'S A TOP GUN?

If you think getting invited to Top Gun would be impossible, you're wrong! To become eligible, a modeler must compete and place at the Scale

Top Gun Numero Uno for a Third Time!

Congratulations to Mr. Top Gun '96—Terry Nitsch, who has, for an unprecedented third consecutive year, stood in the winners' circle. Terry campaigned his well-known silver and red Minute Men F-86 Sabre Jet built from a Bob Violett kit.

Terry's 14-pound, 1/8-scale F-86 is powered by a BVM .91 and a Viojett fan unit. The model is covered with Coverite's* Presto and Ditzler acrylic enamel paint. The F-86 is controlled with a JR* PCM 10SX radio. Terry's model is equipped with BVM retracts and Glennis* wheels, and it has flaps, air brakes and droppable wing tanks.

Terry and Sheila Nitsch proudly show off their F-86 and the number-one Top Gun trophy.

Terry had intended to fly his new BVM F-80 Shooting Star, which he unveiled at this year's Toledo Hobby Show, but technical problems prevented this. So for the last time (TG has a three-years-only rule), Terry flew his winning F-86 at the event. No one doubts that whichever model Terry shows up with next year, he'll be a strong contender. Will he do it a fourth time? We'll see.

Right: Hal Parenti—ninth in Expert; scratch-built, 1/5.7-scale Ryan Fireball; 84 in. span; 28 lb.; balsa, plywood and foam outer wing panels; Parsons glass cloth; Z-Poxy; K&B epoxy paint; polyurethane clearcoat; Airtronics radio; Saito 270 tractor engine; O.S. .91 with Dynamax ducted fan; flaps, drop tanks, Robart retracts, tailhook, landing and navigation lights.

Above: Nick Ziroli's big P-38J Lightning comes in for a low pass; balsa and plywood; fiberglass cloth and acrylic paint; two Zenoah G-45 gas engines; Airtronics radio.

Corvin Miller—fifth place Expert; scratch-built Globe Swift; 80 in. span; 21 lb.; balsa and plywood; Zap; fiberglass cloth and Imron finish; O.S. twin 1.60; Airtronics, scratch-built retracts, flaps, lights, cockpit detail, opening doors.

Left: Jim Allen and Roger Shipley—fifth in Team Scale; BVM kit; 1/6-scale T-33 Red Knight; 80 in. span, 19 lb.; fiberglass, carbon-fiber and foam construction; Zap, Sikkens automotive paint; raised panels and scribed panel lines; BVM .91; Viojett fan unit; JR 10SX radio; 10 servos, gyro, onboard mixture control, BVM retracts, air brakes.

Left: Stephan Durrstein—eighth in Expert; FiberClassics kit; 1/8-scale Douglas DC-3; 126 in. span; fiberglass construction; epoxy paint; two O.S. .91 4-strokes; Multiplex, Fiber-Classics retracts with Graupner sail-winch servo, Kavan tires, flaps.

Pat McCurry—winner of Critics' Choice and Designer Scale awards; Messerschmitt Me-109G-6; 102 in. span; 93 in. long; 43 lb.; fiberglass fuselage, plug-in foam wings, built-up tail; Zenoah G-62 gas engine; APC 22x10 composite prop; fully detailed inside and out; 2 oz.-cloth finish; Z-Poxy; K&B paint; scratch-built functional flaps, retracts and spinner. Rumor has it that Pat might have a kit coming of this great-looking Luftwaffe warbird.

Bob Underwood—10th in Expert; scratch-built, 1/4.5-scale Hiperbipe; 73 in. span; 15.5 lb.; balsa and ply construction; Coverite; Du Pont automotive enamel paint; O.S. 1.60 engine; Airtronics Vision radio; Du-Bro wheels; operational doors. Bob is the president of the National Association of Scale Aeromodelers (created by him in 1977) and the AMA's education director. He was the recipient of a Special Achievement award for his great work with the World FAI committee on the rules (specifically, altering the weight limit from 7 to 10 kilograms, eliminating certain bonus points and lifting the ban on gaseous fuels so that turbines may now compete at FAI level).

TOP GUN Engineering Excellence

One of the most impressive models entered this year was the Grumman TBF Avenger torpedo bomber built by Nick Ziroli Jr. His 49-pound, 108-inch-wingspan Navy warbird was truly a work of art. The Avenger was powered by a Precision Eagle* 4.2ci gas engine turning a 24x10 prop and a Tru-Turn* spinner. A custom muffler system brings the exhaust to the scale exhaust pipe locations behind the radial cowl.

Nick painted and detailed his Avenger with automotive acrylic lacquer paint and duplicated every single panel line, hatch, screw, rib stitch and hinge found on the full-size aircraft. Complete with a scratch-built dummy radial engine and custom-made Robart* retracts, the most inspiring feature was its complicated, articulated, folding-wing mechanism. Each outboard wing panel houses a custom pneumatic cylinder that is attached to an aluminum trunion assembly that, in turn, is attached to another cylinder in the inboard wing section. It's this twin cylinder and trunion assembly arrangement that allows the compound geometry to work as easily as it does, though the work involved certainly can't be considered easy. Nick also incorporated separate pneumatically operated wing-locking pins, and he even duplicated the scale indicator flags. In the full-

Nick poses with his Grumman Avenger before his first-round flight. Nick uses a 10-channel Infinity radio.

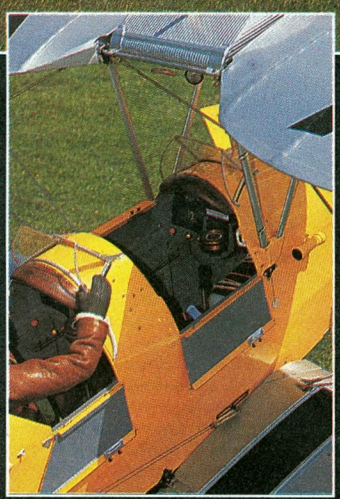
Ian Richardson and Steve Elias—second in Team; BVM kit; 1/6.5-scale T-33 Thunderbird; 80 in. span; 16 lb.; fiberglass and foam; BVM .91; Viojett fan unit; Zap; Coverite Presto epoxy paint; Futaba radio; split flaps, BVM retracts, tires and brakes.*

Jerry Caudle and Bob Violett—High Static (Team), fourth in Team Scale; BVM kit; 1/6.5-scale P-80 Shooting Star; 80 in. span; 20 lb.; fiberglass, carbon fiber and foam construction; JPX T-250 turbine engine; Zap; Coverite Presto; PPG acrylic paint; JR 10SX radio; BVM retracts, wheels, brakes; split flaps, air brakes.

Masters, the Nationals, etc., and be recognized as a serious, competent scale modeler. Then the Top Gun selection committee must get to hear of you. To do this, send a letter of introduction to Top Gun promoter Frank Tiano, or ask someone else to write you a recommendation.

If your modeling and piloting skills are good enough, you'll be invited. Every year, the top 20 contestants are invited to return the following year, but a model may be

The Winning Team



Graeme Mears (right) and Dave Patrick—winners of Team Scale—pose with the winning Tiger Moth.

Some modelers love to *build* scale model while others prefer to fly them. Team Scale brings the two types of modeler together, and teaming the best craftsman with the best pilot is a win/win situation.

This year's Team Scale was won by Graeme Mears and Dave Patrick. Graeme built the absolutely stunning deHavilland DH 82A Tiger Moth, and Dave flew it as if he had been flying it his whole life. Their efforts exemplify what Team Scale is all about—absolute perfection: the model and the piloting skills.

The Model

Graeme's 31-percent-scale DH 82A has a wingspan of 111 inches; its fuselage is 90 inches long and its wing area is approximately 3,500 square inches. The spruce and plywood model took approximately 1,500 hours to build from Frederick Beard plans. Its structure contains more than 1,000 fasteners and over 400 handmade metal fittings. Proctor* turnbuckles, Nelson Aircraft* and Micro Fasteners* hardware are also used.

The 35-pound model is powered by a 7.8hp Moki 3.6, 2-cylinder 2-stroke glow engine equipped with a Bisson muffler. The prop is a Clark Industries* 24 x 8, and the model is controlled with a Futaba radio.

The Tiger Moth is covered with Coverite SuperShrink cloth and finished with dope.

Incidentally, Graeme's Tiger Moth also won Best in Show at the 1996 Toledo show and the 1996 WRAM show.

With wings folded and torpedo-bay door open, the Avenger looks as if it's ready for sea duty aboard an aircraft carrier.

size Avenger, these flags were used to allow its pilot to visually confirm that the wing's locking pins were properly engaged.

Nick duplicated in fine detail the multi-hinge torpedo-bay doors that run along most of the fuselage bottom and the operating tailhook that runs on an internal track and swings into a down and locked position at the end of its travel. No details overlooked! Nick justly deserved the Technical Achievement award, but he did *not* deserve to lose his masterpiece on the first official round! After many successful shakedown flights back home in Long Island, NY, Nick's Avenger fell victim to an unexplained "flyaway." When he had retrieved his model, Nick said that though the Avenger had been extensively damaged, it was indeed repairable and would fly again.

entered only three times. This encourages contestants to build and fly new models, and it ensures a fresh crop of models.

The efforts exerted by TG contestants are awesome; some always compete with a brand-new model. Building a Top-Gun-quality model in 12 months is in itself a monumental task, and you have to allow enough time to learn how to fly it.

Garland Hamilton—seventh in Expert and Best Jet; BVM kit; 1/6.5-scale Lockheed DT-33B Sea Star; 80 in. span, 21 lb.; PPG Concept paint, Pro Mark and painted markings; JPX T-260 turbine engine fueled with propane; Airtronics 10-channel Infinity; flaps, scale cockpit, landing lights, speed brakes, BVM retracts, wheels, brakes.

Geoff Combs and Alvin Brown—Best 4-Stroke Performance, third in Team; FiberClassics kit; 1/9-scale Douglas DC-3; 126 in. span; 34 lb.; fiberglass construction; two YS .91 4-stroke engines; Airtronics Stylus radio; FiberClassics retracts; 14x8 APC props; Deltron acrylic urethane; Pro Mark and painted decals; scratch-built shock-absorbing tail-wheel unit; flaps.

Some specialize in a particular type of model and spend years perfecting it. The competition is very fierce and not everyone can take one of the top spots on the scoreboard, but for many whom I spoke to this year, just being asked to participate was reward enough. Being recognized by your peers is priceless, and so are the modeling secrets you learn and the friends that you make at the event. Though there is only one first place

Sepp Uiberlacher—High Static Score (Expert), 24th in Expert. Scratch-built; 75 in. span; 16 lb.; all-wood construction; tissue/dope finish; HobbyPoxy paint; Super-Tigre 2500; APC 18x8 prop; Futaba PCM radio; homemade retracts; Sullivan tires, flaps.

Dave's Gorgeous Gannet

One modeler everyone was rooting for this year was "Mr. Scale" himself, Dave Platt of Palm Bay, FL. During the previous two Top Guns, bad luck followed Dave, who suffered mishaps involving two of his unique Grumman Mohawk OV-1Ds. But this year, Dave ended his heartbreak run with his beautiful Fairey Gannet A.S. 1.

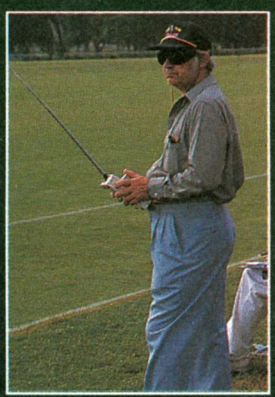
How's this for authentic flap detailing? Very scale.

Dave always chooses unusual aircraft to replicate, and the Fairey Gannet certainly is different. With its joined twin cockpits, counter-rotating props, intricate Fairey Youngman flaps and sub-fin-equipped tail, the Gannet is a true scale modeler's challenge. Dave and Dave Fogarty—his ace pit-crew chief of eight years—are justly proud of this elegant effort.

Specifications

Built in 1/7 scale, the Gannet has an 82-inch wingspan, weighs 19 pounds 15 ounces and is 70 inches long. Built using traditional balsa and plywood construction techniques, the model is covered with Dan Parsons* 0.6-ounce fiberglass cloth and K&B* polyester resin. Dave painted the model, including all the insignia, with K&B epoxy paint.

The O.S.* Max 1.08 glow engine runs on 10%-nitro fuel (18% oil—50% caster and 50% synthetic) and turns an APC* 15x8 prop. A custom, scratch-built muffler is fully enclosed by the engine compartment, and the exhaust is routed through flexible metal tubes that take it out through the scale exhausts aft of the wing's trailing edge. The spinner was scratch-built of turned aluminum. The landing gear are Platt* Competition Specials unit with modified Du-Bro* tires.

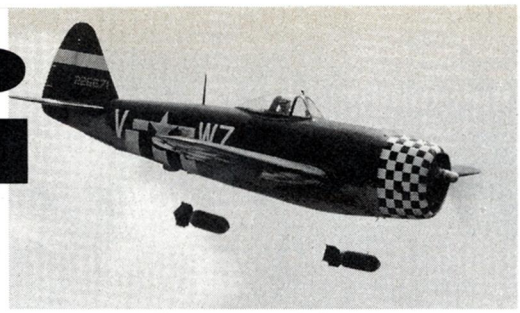


Dave Platt taxies his Gannet out for its first flight.

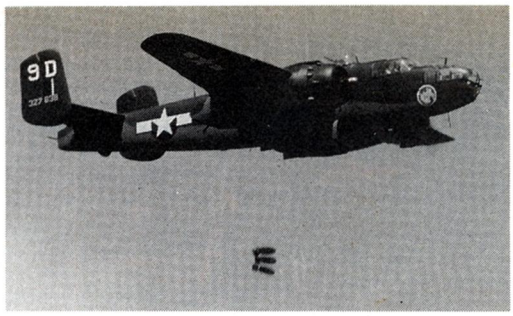
A 7-channel Ace R/C* MicroPro 8000 radio controls the model. Details include full rivet, panel lines and hatch details, flaps, retracts and a tail hook. Flap operation requires eight bellcranks.

The details for this model were acquired by Dave Fogarty, who examined a full-size Gannet at the New England Air Museum near Bradley International Airport in Windsor Locks, CT. Dave placed 33rd in Expert with a 94.417 static score and a total of 153.584.

TOP GUN



One reason why Greg Hahn made such accurate bombing runs with his B-25 was that he practices regularly with his Ziroli P-47 Thunderbolt. Here's the moment of release during a Friday practice flight.



Greg Hahn's B-25J Mitchell releases its ordnance during a bombing run.

TOP GUN WINNERS

EXPERT

Pos.	Pilot	Model	Static Score	Total
1	Terry Nitsch	F-86 Sabre Jet	96.167	189.084
2	David Hayes	Ayres Thrush	97.083	188.458
3	Jeff Foley	Lockheed T-33A	97.000	188.417
4	Charlie Chambers	P-61 Black Widow	97.667	188.334
5	Corvin Miller	Globe Swift	96.917	187.459
6	Greg Hahn	B-25J Mitchell	91.750	187.208
7	Garland Hamilton	Lockheed DT-33 Sea Star	97.500	186.458
8	Stephan Durrstein	Douglas DC-3	95.250	185.917
9	Hal Parenti	Ryan Fireball	94.417	185.250
10	Bob Underwood	Hiperbipe	96.583	185.083

TEAM SCALE

1	Dave Patrick/Graeme Mears	Tiger Moth	92.667	184.209
2	Steve Elias/Ian Richardson	Lockheed T-33	93.833	183.375
3	Geoff Combs/Alvin Brown	Douglas DC-3	90.250	181.750
4	Bob Violett/Jerry Caudle	P-80 Shooting Star	95.250	180.625
5	Roger Shipley/Jim Allen	Lockheed T-33	92.833	179.500

SPECIAL AWARDS

	Pilot	Model	
Critics' Choice	Pat McCurry	Me 109G	
High Static—Expert	Sepp Uiberlacher	Spitfire Mk 16E	97,833
—Team	Jerry Caudle	P-80 Shooting Star	95,250
Best Multi-Engine	Jack Diaz	F-4 Phantom Jet	
—Jet	Garland Hamilton	Lockheed DT-33 Sea Star	
—Civilian	Corvin Miller	Globe Swift	
—Military	Charlie Chambers	P-61 Black Widow	
—Biplane	Graeme Mears	Tiger Moth	
—Craftsmanship	Charley Chambers	P-61 Black Widow	
—Designer Scale	Pat McCurry	Me 109G	
—Foreign Entry	Graeme Mears (Canada)	Tiger Moth	
Engineering Excellence	Nick Ziroli Jr.	Grumman TBF Avenger	
Top Buns	Greg Hahn	–	

PERFORMANCE AWARDS

2-Stroke	Charlie Chambers	P-61 Black Widow
4-Stroke	Geoff Combs	Douglas DC-3
Gas Engine	Greg Hahn	B-25J Mitchell
Aerobatics	Bill Harris	T-33 Thunderbird

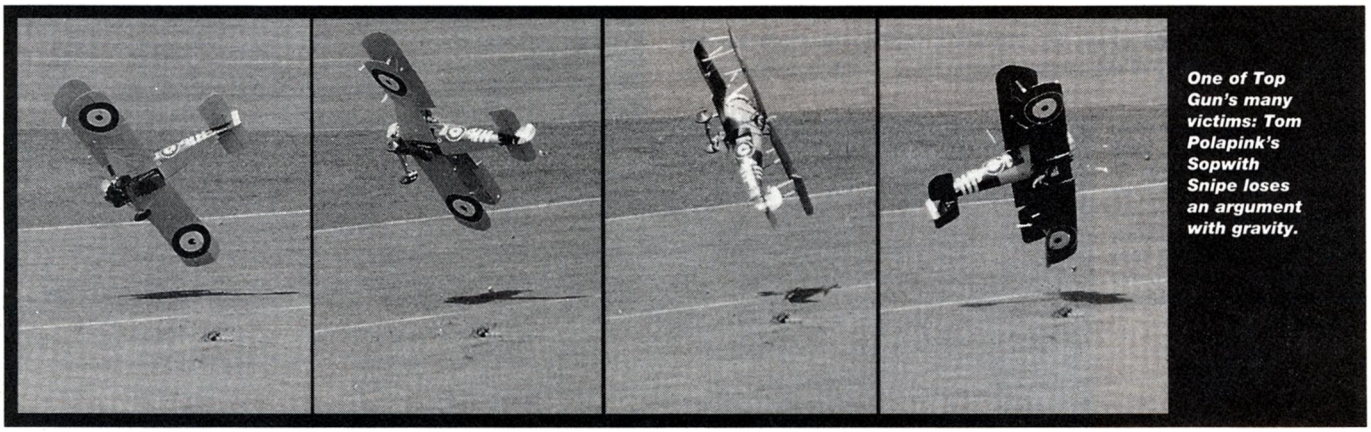
in Expert and in Team Scale, everyone comes away a winner.

This year, there were 29 single-engine monoplanes, 15 jets (three of which were powered by turbines), 11 multi-engine entries (10 twins and one four-engine multi) and seven biplanes. With such a wide range of model types, there truly was something for everyone's aviation interests.

During the four rounds, the attrition rate was very high; 15 models did not return to the pits—at least, not in one piece. A few lost their models to predatory palm trees, and for others, engine-outs, radio problems and midairs took their toll. Unlike in previous years, the wind wasn't to blame for this year's carnage; instead it was that ever-present Murphy and his unforgiving rule! Losing a topnotch model is a tough price to pay, but with time and hard work, most of the casualties will fly again.

SUPPORT AND STANDOUTS

At every Top Gun, we note the sidelines presence of manufacturers and technical support people who cheer on and help the contestants. It goes without saying that FTE's Frank Tiano and Pacer Technology were always on hand with Zap* glue for field repairs. Other regulars were Bob Walker



One of Top Gun's many victims: Tom Polapink's Sopwith Snipe loses an argument with gravity.

(Robart Mfg.), who is a wizard at recognizing and solving retractable-landing-gear problems; Mike Stokes (JR Radio*), who offers technical support to all the JR users on the field; Bob Violett (BVM*), who not only competes but also helps the other BVM jet pilots keep their engines tuned; and Jim Gerard (Gerard Enterprises*), who always helps Moki engine users with any difficulties.

In particular, I saw Jim Gerard work with Graeme Mears when he lost the engine in his deHavilland Tiger Moth. During the third round, pilot Dave Patrick lost engine power and throttle response while flying a loop. When he landed the stricken bird, they discovered that a cylinder had blown off the Moki's 2-cylinder crankcase. Jim Gerard helped Graeme to remove the engine and literally rebuild it right there on the sidelines. And they test-ran it in time for the fourth round! Even more amazing is that after this setback, Graeme and Dave took first in Team Scale with the beautiful Tiger Moth. I'm sure they're grateful for the tech support. Contestants support one another, too. It's part of the Top Gun "thing." Though the stakes are high, cooperation predominates. I think they call that "sportsmanship."

Every entry was a standout, but these come particularly to mind:

• Critics' Choice winner—Pat McCurry with his big and beautiful Messerschmitt Me 109G;

• Best Craftsmanship, Best 2-Stroke Performance, Best Military and fourth in Expert—Charlie Chambers with his impressive P-61B Black Widow;

• Best Gas-Engine Performance and sixth in Expert—Greg Hahn with his 118-inch-span B-25J-1 Mitchell bomber;

• Best Jet and seventh in Expert—Garland Hamilton with his turbine-powered Lockheed DT-33B Sea Star;

• Second in Expert—David Hayes with his Ayres Thrush crop duster. Most people think you need a jet or a warbird to place high at Top Gun, but David proved that with great performance and static scores, a civilian model can place high.

Terry Nitsch's Hot Flash—a JPX turbine-powered showplane seen partway through a snowfall.

TURBINES

The unmistakable sound of turbines—three, to be exact—was also heard this year, not just in demo flights but also in

Top Gun History

The Top Gun Scale Invitational was first held in Coral Springs, FL, on April 21 through 23, 1989. Conceived by Frank Tiano and sponsored by *Model Airplane News* and Pacer Technology, this event brought together the country's best scale modelers for a high-stakes competition to see just who was the best. The stage was set for the grand shootout with 39 participants. When the dust cleared, Bob Fiorenze with his immaculate F/A-18 Hornet had emerged as the first Top Gun, and he went home with $2,000 donated by *Model Airplane News*.

In 1990, the second Top Gun was held at the Spook Hill Flying Field in Arizona. The Team Scale class was added, as was the infamous Top Buns award, which is given by a group of anonymous people known as the "Ladies of Top Gun." Brian O'Meara was the first to triumph in this category!

In 1991, this prestigious event moved to its present location—West Palm Beach, FL, where the Palm Beach Aero Club members are wonderful hosts.

Top Gun Roundup

Year	Expert & Model	Team & Model
1996	Terry Nitsch, F-86	Dave Patrick/ Graeme Mears, Tiger Moth
1995	Terry Nitsch, F-86	Bob Violett/Jerry Caudle, P-80
1994	Terry Nitsch, F-86	Dean Digiorgio/Bob Pickney, Beech C-45
1993	Corvin Miller, Globe Swift	Bob Violett/Jerry Caudle, T33
1992	Charlie Nelson, Waco VKS7F	Dean Digiorgio/Bob Pickney, Beech C-45
1991	Mel Whitney, Hawker Sea Fury	Geoff Combs/Kim Foster, Curtiss Jenny
1990	Ron Gilman, F-86	Gerry Garing/Bob Pickney, Piper J-3 Cub
1989	Bob Fiorenze, F/A-18 Hornet	No team scale

Designer Scale Entries

Many people consider any model not built from a purchased kit to be a "scratch-built" model. Though scratch-building is involved to a certain degree, the correct term for a model built using drawings not drafted by the modeler himself is "plans-built." If a modeler sits down at a drawing board with photos and documentation, develops and draws his own plans and engineers every single piece and sub-assembly, then his model is considered to be truly scratch-built.

At Top Gun this year, there was a special award for just such an effort—the Best Designer Scale Entry award, which was won by Pat McCurry for his beautifully executed Messerschmitt Me 109G.

Here's a roundup of the entries in this class:

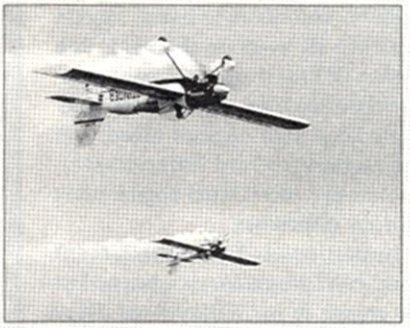
Tom Czick . . . . . P-47 Thunderbolt	Skip Mast C-130	Bud Roane . . . . . Sopwith Pup
Rich Feroldi . . . . . Albatros	Pat McCurry . . . . . Me 109G	Bill Setzler . . . . . Piper J-3 Cub
Mark Frankel . . . . . F4D Skyray	Corvin Miller . . . . . Globe Swift	Sepp Uiberlacher . . Spitfire Mk 16E
Andreas Gietz . . . . . P-51 Mustang	Hal Parenti . . . . . Ryan Fireball	Bob Underwood . . . Hiperbipe
David Hayes . . . . . Rockwell Thrush	Dave Platt . . . . . Fairey Gannet	Jim Wilkinson . . . . Ju-87 Stuka
Art Johnson . . . . . F-82 Twin Mustang	Tom Polapink . . . . Sopwith Snipe	Nick Ziroli Jr. . . . . Grumman Avenger
		Nick Ziroli Sr. . . . . P-38 Lightning

TOP GUN Halftime Highlights

A show within a show! Top Gun's halftime antics alone were well worth the price of admission. This year's aerial ballet was exciting and fresh.

The excitement started with Chip Hyde flying a Lanier R/C ⅓-scale Extra 300s. He was followed by the team of Eric Dern and Don Lowe, who flew an impressive 16-foot-span, four-engine Lockheed Constellation. Powered by four Rossi .80 glow engines, with Don Lowe at the controls, the Constellation handles like some kind of gigantic pattern ship—smooth! Third up was Bob Fiorenze flying a scale Bell 222 helicopter. From takeoff to landing, Bob made everyone want to go out and become a heli pilot.

Don Muddiman lets go of his ZAP Flying Machine—next stop, unlimited aerobatics!



During the halftime show, a pair of Lanier RC giant Stingers flown by Bubba Spivey and Wayne Voyles spew out smoke.

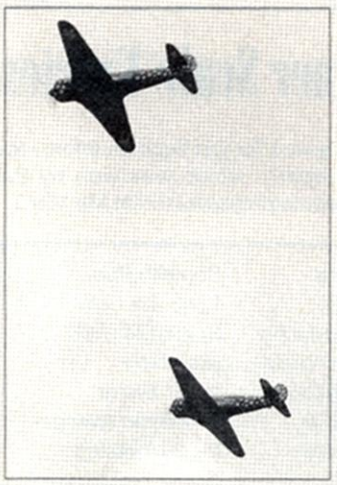
Next up was the German precision formation airshow team of Manfred Hailer and Bernd Albinger. Having flown together for seven years, these guys can really carve up the sky with their Yak 11s built from FiberClassics scale kits. Powered by massive (but very quiet) 140cc 4-cylinder 3W* engines, these red-hot showplanes performed a graceful ballet that used up a lot of sky.

Fifth in the lineup was Geoff Combs flying Dennis Gergits' Carden Aircraft* Extra 300S. An accomplished TOC pilot, Geoff treated the crowd to an example of precision Tournament of Champions aerobatics that was beautiful and technically correct. Mike Barbee was his show announcer. Simply marvelous!

Next, how about 10 R/C combat models all flying at the same time! That's what the Top Gun R/C Combat Team did. Like a swarm of bees, these little Wild Things and Eliminators had the crowd on the edges of their seats..

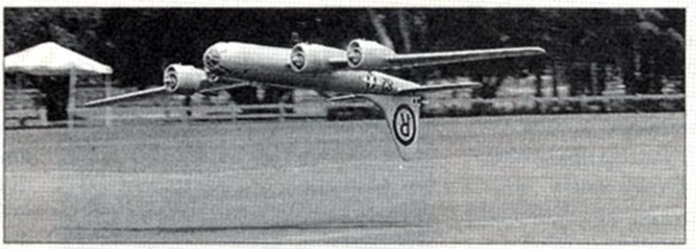
Number seven was Mike Swift and his aerobatic helicopter demonstration—in a word, impossible! At least, that's how his maneuvers looked. Straight and level has no meaning for Mike. How about a loop going sideways? Maybe a hovering roll, or a four-point hammerhead stall turn with an inverted recovery? Then a great, inverted, engine-out autorotation. No, it did not land inverted—but almost! Wow!

Then there was the miniaturized jet pilot Captain Salami, aka Terry Nitsch, who flew his turbine-powered Hot Flash. Terry's routine (complete with simulated, from-the-cockpit commentary) was fast, high and precise. You felt as if you were watching one of the Thunderbirds practicing for a military airshow. Then the Hot Flash broke the scale sound barrier (with the help of pyrotechnics). And they said it couldn't be done!



Number nine was the rough-and-ready Lanier* R/C Show Team of Bubba Spivey and Wayne Boyle, who put their Lanier Giant Stingers through their paces. These guys really rock 'n' roll! Rolling circles, loops around a flat spin and hovering torque rolls were all on their ticket to ride.

In the number-10 slot was the very talented Jason Shulman, who did his thing with a model called the Renegade. Jason—also a TOC pilot—started with a hovering takeoff! Two crew members held his Renegade by the wingtips and pointed it straight up. The hover started less than a wingspan from the ground, and Jason never looked back.



Inverted and low on the deck, Mack Hodges' B-29 roars down the centerline. The Enola Gay also performed loops and four-point rolls.

What was next? Try this: a 16-foot-span, 94-pound B-29 Super Fortress bomber flying aerobatics!—not exactly prototypical flight realism, but exciting nevertheless. Flown by Mack Hodges, the B-29 was powered by four Quadra gas engines. Low and inverted (the tail almost touching the grass), the Enola Gay did loops, rolls and four-pointers that had everyone's attention.

And last, but not least, was Don Muddiman and his impressive ZAP Flying Machine. Don is famous for fast *snap* maneuvers—very tight ones! His performance ended with a landing approach that started straight overhead, just under the clouds. Dead-stick, of course, he aims the model straight at the ground and pulls out at the last possible moment. Add a lazy snap roll before touchdown and it's finished. Wow!

Piloted by Manfred Hailer and Bernd Albinger of Germany, a pair of FiberClassics Yak 11s powered by 140cc gas engines perform an impressive formation flight.

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- Frank Tiano Enterprises
- Pacer Technology

Merchandise

- Futaba—8-channel radio (High Static Expert)
- Gerard Enterprises—Moki 1.8 (Best 2-stroke Performance)
- Herr Engineering—trophies (Mass Rubber-Powered Launch)
- Horizon Hobby Distributors—Saito 1.50 (Best 4-stroke Performance)
- Jim Meister—four $50 certificates
- JR Radio—7-channel radio (High Static Team)
- McDaniels R/C—onboard glow system
- *Model Airplane News*—subscriptions and T-shirts
- Nick Ziroli Plans—cocktail party co-sponsor
- Pacer Technology—pit towels, repair kits and judges' hats
- Pan American Distributors—spectator prizes
- Pro Mark—pit towels and custom markings
- Prop Wash Videos—cocktail party co-sponsor
- Spring Air—⅕-scale retracts
- Top Gun Hussies—Aviation Book (Top Buns Award)
- Van Dell Jewelers (Critics' Choice Award)

Cash—secondary sponsors
($200 plus custom trophy)

- Airtronics—Critics' Choice
- Bob Violett Models—Best Jet Aircraft
- Carden Aircraft—Best Civilian Aircraft
- Dave Platt Models—Best Foreign Entry
- Don Smith Plans—Best Military Aircraft
- Glen Torrance Models—Best Designer Scale
- Hubby Nut—Best Multi-Engine Performance
- Lanier RC—Best Aerobatic Performance
- North American Power R/C—Best Gas-Engine Performance
- R/C Report—Best Biplane
- Remote Control Television—High Static Score (Team)
- Robart Manufacturing—Engineering Excellence Award
- Scale R/C Modeler—High Static Score (Expert)

Additional sponsors

- Midwest Products
- Ray & Robin's Hobby Center
- Top Flite Models
- Madden Model Products

Jim Gerard of Gerard Enterprises helps Graeme Mears with his Moki engine. During a flight, Graeme lost a cylinder, and Jim helped to get his Tiger Moth back in the air for a win in Team Scale.

competition. Flying a JPX T-250 turbine-powered BVM P-80 Shooting Star, Jerry Caudle and Bob Violett placed fourth in Team Scale. Garland Hamilton's beautiful Lockheed DT-33B Sea Star (also built from a BVM kit) was powered by a JPX T-260 turbine. And the third turbine-powered model was a ⅐-scale F-80—a modified JMP* T-33 kit—entered in Team Scale by Albert Araujo and flown by Rei Gonzalez. A Turbomin* turbine provided the thrust.

From what I saw of these jets, I know turbines are here to stay. (What is it like to fly a Top Gun turbine? See "Final Approach" in this issue.)

All this and the most beautiful scale model airplanes in the world to boot; how could anyone not feel that they got their money's worth at the 1996 Top Gun extravaganza?

I hope I have at least given you a feeling for what this Top Gun thing is all about. More than just a scale contest and a beautiful collection of scale models, Top Gun strives to present the very best of scale R/C aviation. Many thanks to all the hard-working individuals behind the scenes and to all the sponsors who helped support this event.

If you haven't yet attended, try to pencil Top Gun 1997 into your schedule; you'll see firsthand what it's all about. See ya there!

**Addresses are listed alphabetically in the Index of Manufacturers on page 128.*

Foreign Entries

Name	Country	Model
Stephan Duerrstein	Germany	Douglas DC-3
Jack Diaz	Venezuela	F-4 Phantom Jet
Ralf Ploenes	Germany	F-80
Andreas Gietz	Germany	P-51 Mustang
Eduardo Estevez	Brazil	Rearwin Skyranger
Chris Burridge	Canada	Spitfire LF 16E
Sepp Uiberlacher	Canada	Spitfire Mk 16E
Graeme Mears	Canada	DH 82A Tiger Moth
Karl Gross	Canada	Nieuport 11

Some of the many hard-working Palm Beach Aero Club members who helped to ensure that Top Gun ran smoothly.

Top Gun Staff

Contest director: Frank Tiano
Contest Manager: Ken Von Thaden
Chief judge: Tim Farrell
Assistant chief judge: Bill Holland
Static judges—Expert: Bob Curry (capt.), Lee "Zip" Henderson, Bill Deverna
Static judges—Team: Harvey Tomasian (capt.), Steve Harris, Charlie Beer
Score-keeper: Rosella Curry (score-keeping program: "Simply Scale" by Cliff Tacie)
Flight judges: Stan Alexander, Darlene Frederick, Wayne Frederick, Tom Kozel, Jim Parker, Jim Semonian, John Smith, George Jenkins
Radio impound: Dawn Buckley

MODEL AIRPLANE NEWS

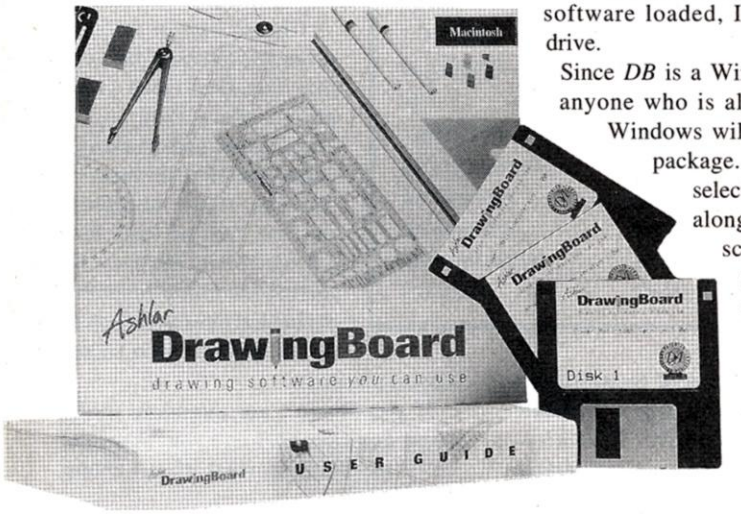
PRODUCT REVIEW

A powerful, easy-to-use CAD program

MCE DrawingBoard

by BILL GRIGGS

I HAVE been slowly teaching myself to use computer-aided design (CAD) programs for the past four years. I wanted to be able to draw plans for my electric airplanes and change the designs as I found better ways to do things. CAD provides this creative freedom, and I am really sold on it. That is why, when I had the opportunity to learn a fourth CAD program and review it for this magazine, I gladly accepted the challenge.



MCE's "DrawingBoard" is available for IBM, Power Macintosh and Macintosh computers.

Mid Columbia Engineering's* (MCE's) *DrawingBoard* is billed as "Drawing software you can use," and the program lives up to this claim. I found it to be a powerful, streamlined package that is easy to use and costs only $135. You will spend more time drawing than learning complex commands.

DrawingBoard is a 2-D version of the more powerful and more expensive program called *Vellum*. *Vellum* is a 3-D drafting program that is used by such notable people as Burt Rutan. *DrawingBoard* gives you some of *Vellum*'s nice features for a tenth of the cost.

LET'S LOAD UP

DrawingBoard (*DB*) is a Windows-based program that comes on three 3.5-inch disks. It can be operated under Windows 3.1 or Windows 95. Macintosh users, don't despair: there is a version of *DB* for you, too. I loaded *DB* into my 486DX2 66MHz computer, but it can be run on machines as slow as a 386DX 25MHz. You will need at least 8 megabytes of RAM and about 10 megs of hard disk space.

I had no trouble loading the software into my computer; the hardest part for me was waiting for the disk to load. With the software loaded, I took *DB* for a test drive.

Since *DB* is a Windows-based system, anyone who is already familiar with Windows will easily adapt to the package. *DB*'s window has a selection of drawing tools along the left side of the screen. Each tool also allows you to access several related tools in sub-windows.

FEATURES

The number of features I discovered in the short time I had *DrawingBoard* for this review is staggering. I'm sure that the program has many more unique features for me to learn.

• **Import and export.** More expensive CAD programs are generally the only ones that allow you to transfer drawings from other programs. But *DB* allows you to import bitmapped (BMP), Windows Metafiles (WMF) and Data Exchange Format (DXF) drawings, as well as text and coordinates from an ASCII text file.

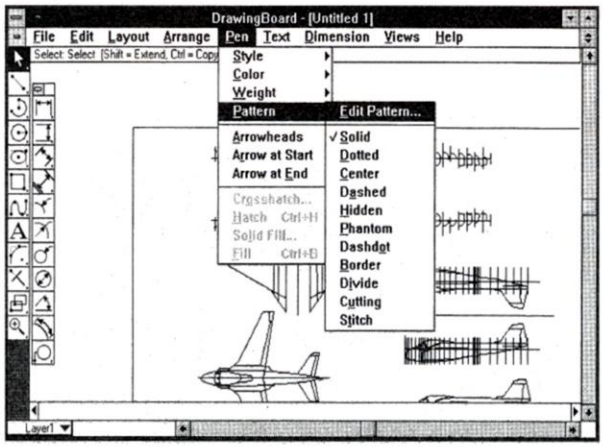
• **BMP.** Drawing programs, more than drafting programs, use BMP files, which are perhaps the most widely available type of drawing files. BMP is the default setting for *Paintbrush*—the drawing program that is included in every Windows package. Online services such as CompuServe and America Online have huge libraries of BMP files available for the cost of the download time.

• **DXF.** This is the format used by *AutoCAD* and several other high-end CAD programs to facilitate the exchange of drawing data. The capacity to import and export DXF files puts *DB* in an élite class with some of the big players in the CAD marketplace. I successfully loaded a drawing that I created using *AutoCAD 12* into *DB*. All the drawing elements were of the same sizes and in the same positions after the transfer. Nice!

• **Text files.** *DB* can use ASCII text files in two ways:

First, it can import text directly into a drawing. This allows you to create instructions and callouts for your latest aircraft design on your word processor and then export the text into the appropriate place on your plans. You can spellcheck documents and use fancy text styles (fonts) that *DB* can't create on its own.

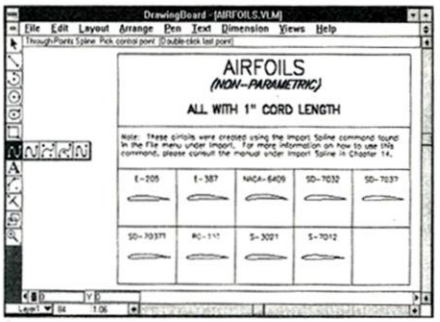
The second and more powerful way that *DB* uses imported text files is to create



"DrawingBoard" is a Windows-based CAD program that's fast and easy to use. To the left of the screen is the tool bar for different drawing applications. Across the top is a pull-down window menu for other applications. If you're comfortable with Windows 3.1 or Windows 95, you'll find "DrawingBoard" very similar.

complex shapes. *DB* can use a set of coordinates from a text file to create a spline. Splines are smooth, curved lines, such as those on the top and bottom of an airfoil. Airfoil plotting data is available from a variety of sources.

• **Drafting Assistant.** This is the most useful tool in the *DB* arsenal because it helps you align all the elements in your drawing. This feature automatically indicates commonly used reference points throughout your drawing. For instance, when you draw a circle, Drafting Assistant shows the center point, intersect points and tangent points on the circle. You can select a key point to serve as the reference for a new line. Move the cursor to where you want the line to appear, click on the mouse, and the line will be drawn according to the key point that you selected. In most CAD programs, you must take your hand off the mouse to type commands such as "endpoint." With *DB*, you simply let Drafting Assistant do the work for you. Nice feature!

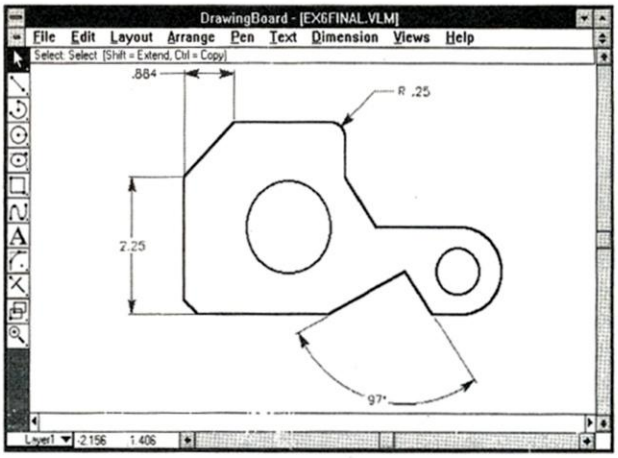


"DrawingBoard" allows you to import and export drawing files from and to other CAD programs. You can work with splines—smooth, curved lines such as those used in drawing airfoils—from BMP, WMF, DXF, or an ASCII text file.

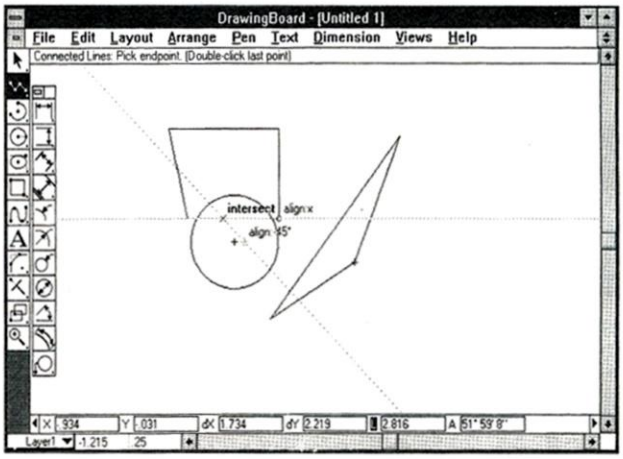
• **Parametric control.** This is something usually reserved for high-cost, top-end CAD programs. It's a feature that automatically redraws geometric shapes to measurements that you specify. *DB* can handle two types of parametrics, normal and variable.

To use normal parametrics, draw the shape and then use the editing tools to specify the lengths and angles needed to accurately re-create that shape. Basically, this method allows you to draw a rough sketch and then specify the exact lengths involved. Or if you draw a square and discover that you need a rectangle, you can correct the error without manually redrawing the part. Simply select the square and fill in the lengths in the appropriate places. Poof! You now have a rectangle.

Variable parametrics is even more powerful and allows you to specify a variable for the length of a line. This allows you to create shapes based on geometric formulas; in other words, you have the flexibility to create shapes that can be expressed geometrically.



"DrawingBoard" is a powerful drafting program that gives you features usually reserved for more expensive programs. You can draw, then modify lines, angles, radiuses and much, much more.



Drafting Assistant is a special feature that can automatically align elements of your drawing. Common alignments are for the center of a circle, tangents and endpoints.

SPECIFICATIONS

Name: *DrawingBoard*

Type: Windows-based, 2-D, computer-aided design

Distributor: MCE

Memory req'd: 8 megs RAM and 10 megs of hard disk space

Versions available: IBM, Macintosh and Power Macintosh

List price: $135

Features: *DrawingBoard* comes with a 300-plus-page instruction manual and three installation disks. Program features include Tool Box, Drafting Assistant, normal and variable parametric control, Smart Wall and spline import capabilities for BMP, WMF, DXF and ASCII text files.

Comments: this is a 2-D version of the more powerful and expensive *Vellum* 3-D program used by such notable people as Burt Rutan. *DrawingBoard* has many features found only in high-end CAD programs and is very easy to use.

Hits

- Ease of use.
- Powerful features usually found in more expensive CAD programs.
- Excellent instruction manual.
- Ability to import graphic files from other programs.

Misses

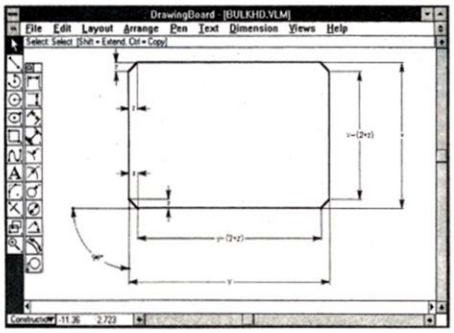
- Won't work on computers that don't have math coprocessor hardware. Most new computers come with it installed.

I used the variable parametric function to create a bulkhead symbol for a slab-sided fuselage. I can now simply supply the symbol with the dimensions of the fuselage sides and the size of the corner triangle stock, and *DB* will create the bulkhead symbol in any size I want.

• **Smart Wall.** Lastly, there's the Smart Wall feature—a tool that creates parallel lines such as those in architectural drawings. It draws walls (or double lines) and then automatically trims them where lines intersect or touch. You can change the length and width of the walls easily. If you think that Smart Wall isn't handy for model building, think again.

In only 10 minutes, using Smart Wall, I created the

wing layout shown in this article. I specified the length of the wing panel and the thickness of the leading-edge piece. Next, I indicated how wide the tip block should be, followed by the widths of the trailing edge and the root rib. Then I drew the first rib and had *DB* space the ribs out along the wing. When I had finished with one side of the wing, I simply made a "mirror" copy of it and ended up with a complete wing layout—quick and easy.

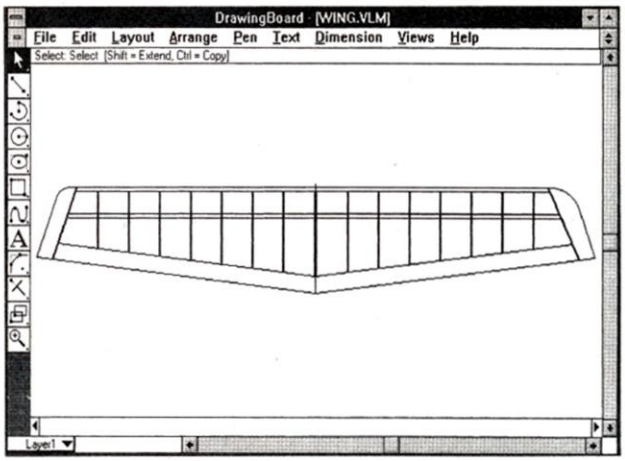


With the parametrics control feature, you can draw items that are expressed geometrically. Here is a bulkhead that "DrawingBoard" automatically drew after I entered the length, width and corner-triangle-stock size data.

The only limitation in using DB will be your computer. DB needs to be used with a computer that has math coprocessor hardware. But this is included with most new computers today.

WAIT, THERE'S MORE!

There are so many more features in *DrawingBoard* that I would need to write a book to tell you about them all. But MCE provides it in the form of their excellent, 300-plus-page instruction manual. I believe that *DB* has something for everyone. If you can't tell by now, I am thoroughly impressed with this CAD program. It's easy to use and doesn't cost an arm and a leg. If you've been looking for a drafting program that doesn't require a computer science degree to understand, give *DrawingBoard* a try. It might just be for you.



This wing layout took about 10 minutes to draw using the Smart Wall feature. Intended for architectural drawing, Smart Wall can be used in many model drawing applications.

**Addresses are listed alphabetically in the Index of Manufacturers on page 128.*

About the author

A 10-year veteran of the New York State Police, Bill Griggs is a PC coordinator and computer instructor with the force. He has a degree in computer sciences and is pursuing a B.S. in computer-aided drafting and design. He has been involved in model aviation since 1975 and flies electrics, competition sailplanes and helicopters. Bill hopes to be discovered by a model company that will pay him outrageous sums and force him to fly, build and design model airplanes for a living.

MODEL AIRPLANE NEWS

FIELD & BENCH REVIEW

The Tsurugi XX can be built quickly and has excellent flight characteristics—well within the capabilities of a novice chopper pilot.

Hirobo/Altech

Tsurugi XX

Improved performance for the serious heli pilot

by MICHAEL CINGARI

THE TSURUGI XX helicopter is Hirobo's* top-of-the-line version of the two-year-old Tsurugi .60-size kit. The original, which I reviewed in the April 1994 issue, has well over 400 flights on it, and it has been flown by many pilots. Needless to say, I was very interested when I discovered that Hirobo now offers an improved version.

The Tsurugi XX flies well in all attitudes, and its improved components ensure its longevity.

NEW FEATURES

On opening the box, one of the first improvements that I noticed was that the clear Lexan canopy now comes trimmed and drilled. My friend and professional canopy painter Steve Sprague worked on the canopy. Steve glued the two halves together with Zap* and wet-sanded the canopy with 400-grit sandpaper. He painted the masked windscreen with white K&B* SuperPoxy then applied the new-style decals and sprayed the entire canopy with clear SuperPoxy. The results look fantastic.

The next improvement I found were the finished wooden main rotor blades. These new blades are semi-symmetrical and weigh much more than the original Tsurugi blades. They greatly improve the heli's flight characteristics, especially autorotation. They're

SPECIFICATIONS

Manufacturer: Hirobo

Model: Tsurugi XX

Type: .60-size helicopter

Main-rotor dia.: 60 in.

Tail-rotor dia.: 11 in.

Weight: 10.5 lb. (ready to fly)

Length: 52.5 in.

Engine req'd: .60

Engine used: Enya XF .60

Radio req'd: 5-channel with 5 servos

Radio used: JR PCM 10SX

Gyro used: Futaba G501 piezoelectric

Features: main-rotor head and the tail-rotor gearbox come assembled and ready to be installed; fan-and-clutch system is very simple and doesn't require any alignment checks; stronger main-frame construction; excellent manual with instructions for this Tsurugi XX and the original; rotor blades are pre-built; pre-trimmed Lexan canopy; slipper-type autorotation clutch.

Comments: so much work has been done by Hirobo that I took only about 15 hours to assemble the heli, install the engine and radio equipment and it was ready for flight.

Hits

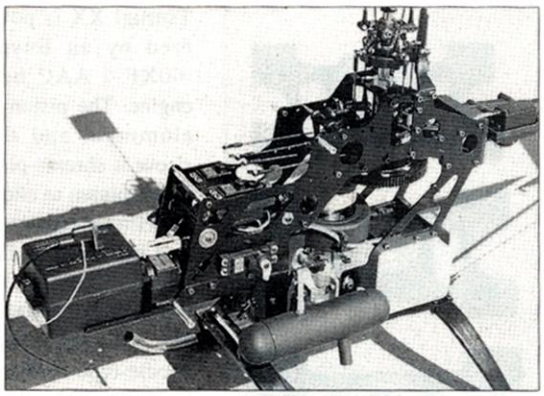
- Pre-assembled components.
- Pre-trimmed Lexan canopy.
- Pre-built main-rotor blades.
- Very easy to maintain.
- Excellent flight characteristics.

Misses

- Starting shaft not included.

covered in clear heat-shrink plastic and have lead weights laminated inside the wood near their tips. I glued the plastic blade grips onto the roots. The blades' total finished weight was 195 grams, and they're 660mm long. On my blade balancer, they checked out perfectly.

The main gear is attached to an aluminum hub and comes with a driven tail. This allows tail-rotor control during autorotations.



The wide side frames make the XX very easy to work on. Note the rear location of the tail-rotor servo, and the push/pull on the cyclic and collective servos is standard.

The tail-rotor gearbox is identical to that of the stock Tsurugi, but the XX has dual-ball-bearing-supported tail-rotor blade grips that stiffen the tail-rotor system and improve control response. The blades have curved tips and are ½ inch shorter than the originals.

The XX comes with a stainless-steel torque tube for the tail-drive system (this replaces the wire tail drive of the stock kit). This pre-assembled unit rides on two ball-bearing supports and is ready to be installed in the octagonal tail boom. Both ends of the drive tube have dogbone-type sockets; to remove the tail boom, simply remove a ball link, loosen a few bolts and slide it out.

The main- and tail-rotor drive-gear unit has a machined-aluminum hub that supports the autorotation bearing and replaces the original one-piece plastic main gear. It's much stronger, uses two separate gears and runs absolutely true. The new tail-bevel ring-gear system incorporates a new gear ratio that results in a lower tail-rotor speed; this provides excellent tail authority without any loss of main-rotor-system power. This new main-gear assembly is now included on all Tsurugi kits and is available as an upgrade (part no. 0404-555).

The XX comes with a slipper-type

The Tsurugi XX has the exceptional flight characteristics of the original version. In its stock form (unmodified), it's one of the most relaxing helicopters to fly.

FLIGHT PERFORMANCE

• Hovering

The Tsurugi XX hovers very solidly, and inverted hovering is surprisingly easy because it's so stable. In fact, this heli's inherent smoothness makes my flying look better.

• Forward Flight

The Tsurugi XX tracks quite well in forward flight. You'll have to use that left thumb to help coordinate turns. The gyro will try to keep the tail rotor weathervaning into the wind, so directional tail-rotor input with the left hand is essential.

• Aerobatics

Large pattern-style aerobatics can be done effortlessly. If you enjoy 3-D flying, the Tsurugi XX does very well in the tumble department, yet it maintains its mild hovering manners when you want to take a break from slicing up the sky. With proper mixing and technique, forward and backward flips track straight.

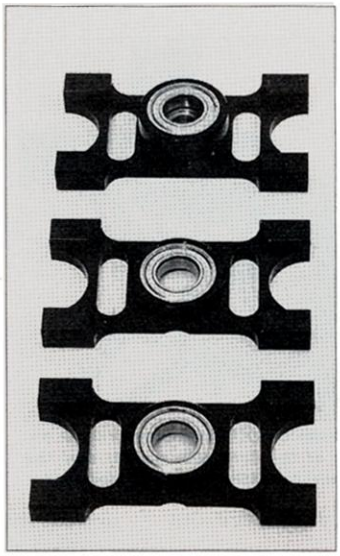
I'm using the stock paddles with the weights removed; this makes the XX roll very quickly (about 1½ rolls per second). Despite its nimble response as a result of this change, it's still fantastically stable. I prefer to fly the 690mm symmetrical Miniature Aircraft* Rotor Sports 3-D carbon rotor blades because they enhance the already impressive flight performance. At the bottom of autorotation landings, there's ample hang time, and that allows soft touchdowns.

• Maintenance

Before the XX version was released, I had logged more than 500 flights on numerous Tsurugis over 18 months. The only maintenance I've found necessary was the replacement of head dampers every 100 flights or so; this takes only a couple of minutes. The clutch and clutch lining are still good, and the drive train seems to be bullet-proof. With the added ball bearings, stainless-steel tube drive and metal bearing blocks, the XX should be even more durable than the original. The Tsurugi XX's reliability will give anyone enough confidence to push his flying skills to their limits.

autorotation clutch that can be adjusted with shims to provide tail-rotor control during autorotations. During an engine-out landing, this feature robs the main-rotor system of power, but it can make autorotations easier because you can now align the helicopter with its direction of flight before touchdown.

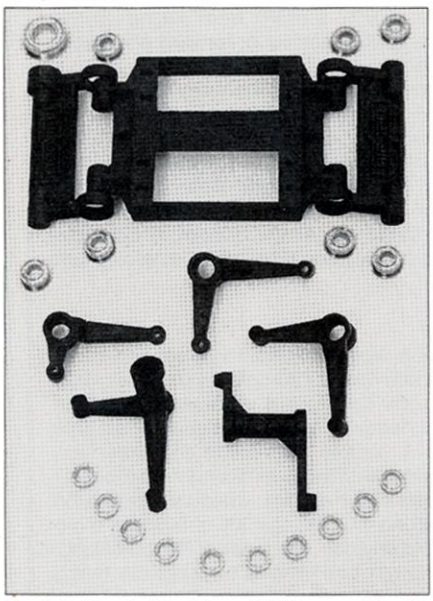
In the main frame area, three machined-aluminum bearing blocks replace the original plastic ones. These blocks support the main shaft and engine/clutch assembly and strengthen the side-frame assembly. The XX is very strong because the side frames are well-supported and nearly 3 inches apart.



The all-aluminum bearing blocks support the main shaft and clutch bell perfectly.

The control levers between the side frames are supported by 10 ball bearings instead of bushings. The servo tray's bushings have been replaced by an additional seven ball bearings. This brings the total number of ball bearings in the cyclic and collective system to 18. This improvement alone is worth its weight in gold because it makes control response freer and more precise.

When assembling any ball bearing on its associated shaft, it's important to secure the inner bearing races to the supporting shaft with Loctite* 290 (Green Loctite) to prevent the bearing from spinning and vibrating on the shaft and subsequently damaging it. Before you apply any type of Loctite, make sure that all the hardware is clean.



Contributing to the Tsurugi XX's smooth collective system are this ball-bearing-supported servo tray and levers.

• **Powerplant.** The Tsurugi XX is powered by an Enya* .60XF-4 AAC heli engine. The piston is aluminum and the sleeve is chrome-plated aluminum to allow for thermal expansion and ensure that the piston-to-sleeve fit remains consistent. The XF-4 has a two-needle-type carburetor that works well and is user-friendly. The 1.7hp powerplant powers the helicopter smoothly and reliably and requires only a short break-in.

• **Electronics.** Guidance is provided by a JR* PCM-10SX radio with 4-4131 servos and one JR 4000 super servo on the collective. In any .60-size helicopter, to provide strength and feedback from the servos, you must use coreless heavy-duty servos.

I also used Futaba's* new G501 piezoelectric gyro, which features a very fast response time that allows a higher gain setting to be used. It locks the tail in place very well and handles engine torque and wind changes much better than a conventional gyro. This type of gyro has no moving parts, and that means a longer life and no degradation of performance. The Tsurugi XX has a gyro plate above the fuel tank, but I prefer to install it on the front radio tray to help isolate the sensor from vibration and keep it away from the exhaust residue. In addition, mounting the gyro up front will bring the CG into place without the addition of nose weight.

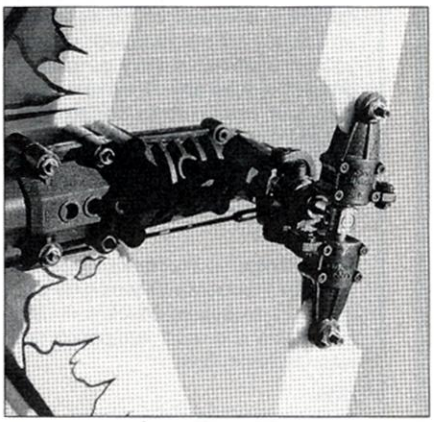
• **Setup.** I adjusted the lengths of the control rods to equalize the available positive and negative pitch travel. I did this by positioning the servo tray on end (center of travel) and adjusting the rods going from the servos so that the L-lever arms are vertical. I then adjusted the next set of rods above the L-levers so that the swashplate was in its center of travel. Finally, I adjusted the rods above the swashplate to make the main rotor blade grips level (zero degrees). This gave the XX an available pitch range of +12 to -12 degrees and provided more than enough collective pitch travel.

Using a combination of servo arms and electronic adjustments, I made the final pitch settings as follows.

• **Normal flying**
-4 degrees at low stick;
Zero at quarter stick;
5 degrees at half stick;
9 degrees at high stick.

• **Stunt mode**
-9 degrees at full low;
Zero at mid stick;
9 degrees at full high.

These numbers will vary with available engine power and desired rotor rpm. I run 1,700rpm for my style of flying, but the XX is very happy at any speed from a very low 1,100rpm to a screaming 1,900rpm.



The Tsurugi XX now comes with dual, ball-bearing-supported tail-rotor-blade grips that improve tail-rotor control response.

CONCLUSION

The upgraded Tsurugi XX can be built more quickly and is more precise than the original. It still has the original's push/pull cyclic control system, pre-assembled components and other fine features, but it has all the latest updates. It's a pleasure to build and even more fun to fly. The kit is straightforward enough for a novice to be successful with it, and in expert hands, its flight characteristics make it a capable of flying aerobatics and difficult maneuvers. Whether you enjoy 3-D flying or just cruising around, the XX is hard to beat.

**Addresses are listed alphabetically in the Index of Manufacturers on page 128.*

About the author

Texan Mike Cingari has been flying R/C aircraft for about 26 years, and now prefers helicopters to planes. Don't hold that against him though! He is a member of the Irving R/C Fliers Association, and for the past few years, has been the designated grounds keeper—trimming the trees and cutting the grass with his inverted flying technique!

MODEL AIRPLANE NEWS
HOW TO

A Sunday flier's viewpoint

Brush up on Brushless Motors

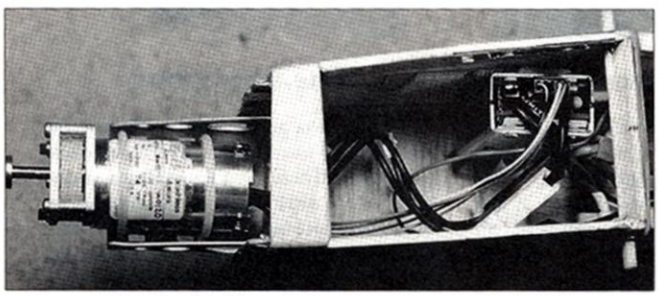
by BERNARD CAWLEY JR.

PHOTOS BY BERNARD CAWLEY JR.

A size comparison of the motors tested (left to right): AstroFlight geared 25, Aveox 1409/3Y, MaxCim Max 15-13D, Aveox 1406/3Y, Model Electronics Turbo 10.

I'M INTRIGUED by the potential performance improvements we electric fliers might gain from brushless technology. In the Electric Power section of ModelNet on CompuServe, I've read comparisons of the merits of brushless motors and brushed motors.

The arguments are: brushless motors are more efficient, they require no maintenance, they are compact, and they generate less RF interference, but they are more expensive and the necessary special speed controls are more complex, heavier and bulkier. Recent articles and advertisements have given the impression that, for all-out performance, brushless motors are the way to go, and their success in international competition has proven that.



A MaxCim 15-13D motor and speed control in the Elf.

But what about those of us who fly electrics for fun? For us, what justifies the higher initial cost of brushless systems? A little more efficiency or the ability to handle massive amounts of power in short bursts are not top priorities for folks who want to fly scale, scale-like or sport-aerobatic planes for fun, or who just want to go out and shoot touch-and-go's all Sunday afternoon.

I had heard that the same brushless motor and speed control could be used in both a 6- to 8-cell, entry-level plane and—with a different prop and perhaps a change in gearing—a more advanced, 16- to 21-cell plane. Performance in both applications would be comparable to that of the best brushed motors.

BRUSHLESS MOTORS

Today's brushless systems consist of a motor and a matched speed control. The motors look like the ones we're familiar with, but they have no cooling openings or brush holders and no capacitors; and instead of two wires emerging from the rear end bell, there are three power wires and five much smaller ones.

Inside, however, the motors are quite different. The permanent magnets are attached to the shaft, and the wire coils are fixed to the case. Instead of brushes, electronic sensors determine the rotor's position and send that information through the five small wires and back to the speed control.

A brushless motor needs an electronic speed control (ESC) that's somewhat bulkier and heavier than the electronic controls now used with brushed motors. This is because it not only has to regulate motor speed, but it also has to electronically perform the tasks done by the brushes and commutator in a conventional motor. On one end, there are connectors to mate with the eight wires that come from the motor, and on the other end, there's wiring to go to the rest of the plane's power system.

AVEOX AND MAXCIM MOTORS

For this article, I tested the Aveox* 1406/3Y and 1409/3Y and the MaxCim* Max 15-13D motors. Both look and feel like finely crafted machinery. Each type has two sets of 1-inch-spaced mounting holes in the front endbell. The only things that protrude beyond the case are the heads of the screws that hold the endbells in place.

Aveox motors and speed controls come with Sermos connectors, but they are not installed. MaxCim motors have Anderson Powerpoles installed at the factory. I used the Model

MaxCim Max 15-13D

Dimensions: 1.4x2.4x3/16 in. (dia. x length x shaft)

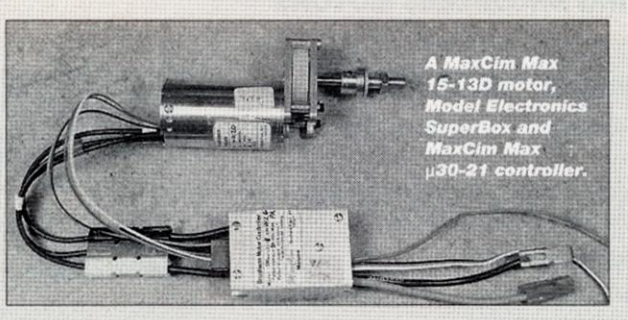
Weight: 9.4 oz. (with MEC SuperBox)

Power rating: 750 watts

Wire/connectors: 4 in. long Anderson Powerpoles installed. Hall sensor wires (approximately 8 in.)

List price: $339.95 (motor, ESC and gearbox)

Comments: runs very smoothly; does not cog. Odd shaft size limits gear- and prop-driver sources. Timing adjustments neither provided nor necessary.



A MaxCim Max 15-13D motor, Model Electronics SuperBox and MaxCim Max µ30-21 controller.

■ Speed control—Max µ30-21

Type: microprocessor-based, digital high rate

Dimensions: 2.3x1.5x0.9 in.

Weight: 3.4 oz. (ready to use)

Power rating: 21 cells max.; 35A continuous current

Wire/connectors: 4-in. power wires; Powerpole connectors installed; 6-in. Futaba* J receiver lead; 12-in. power input wire; no connector.

BEC/cutoff: selectable with jumper plug

Brake: activated by throttle trim

Adjustments: none; range fixed; start point taken from throttle pulse at power-up; motor timing electronically adjusted for rotation direction.

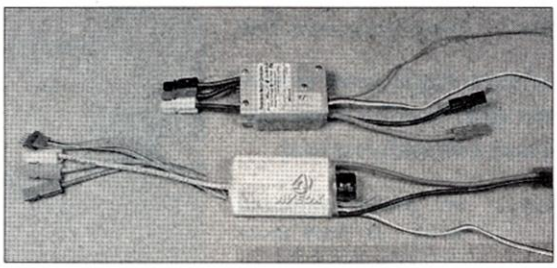
Rotation direction: select with jumper plug.

Comments: aluminum case; no exterior components; immune to interference (good on loss-of-signal test). Very responsive; smooth response over full throttle range.

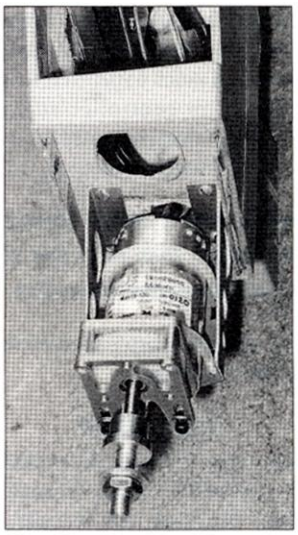
Electronics Corp.* (MEC) SuperBox on all three motors because of the wide number of gear ratios available.

The MaxCim motor can be ordered with a 2.5:1 or a 3:1 SuperBox already installed and adjusted. As supplied by MaxCim, it has sealed bearings rather than the open ones MEC uses. The MaxCim controller has a unique red wire that has to be tapped into the motor battery's positive lead, ahead of the power fuse. This wire, which doesn't come with a connector, provides power for the controller, and if used in battery-eliminator mode, for the radio system as well. When you've connected the red power wire, the MaxCim system is ready to be plugged together and run. Like other microprocessor-based speed controls, you don't have to adjust it to match your radio system.

On the back of the Aveox control, accessed through small holes cut in the heat-shrink wrap, are two adjustment potentiometers—one for range and one for end-point adjustments. This is similar to the better analog speed controls, such as the Jomar SM-4 or AstroFlight* 205 available for brushed



The MaxCim (top) and Aveox brushless controllers.



The MaxCim 15-13D on the Stitzer MM-1 motor mount in the Elf.

Aveox 1409/3Y

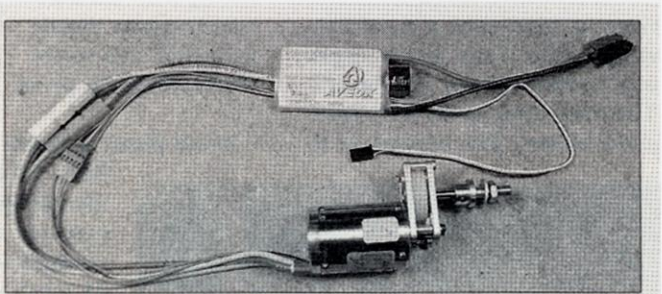
Dimensions: 1.5x2.2 in. x 5mm (dia. of motor case x length x dia. of shaft)

Weight: 10.4 oz. (with MEC SuperBox; supplied wires shortened to 6 in.)

Power rating: 900W

Wire/connectors: 11 in. long (as supplied); Sermos; not installed

Comments: runs smoothly, once started; cogs strongly; generous lengths of wire; adjustable timing.



An Aveox 1409/3Y motor with a Model Electronics SuperBox and an Aveox F5MV controller.

■ Speed control—F5MV

Type: analog, high rate

Dimensions: 2.1x1.5x0.4 in.

Weight: 3 oz. (supplied); 3.2 oz. (ready to use)

Power rating: 7 to 21 cells; 60A continuous current

Wire/connectors: 6-in. power wires; Sermos connectors (supplied; not installed; 6-in. Futaba J receiver lead; 6-in. Hall sensor wires; 5-pin plug (mates with plug from motor).

BEC/cutoff: none

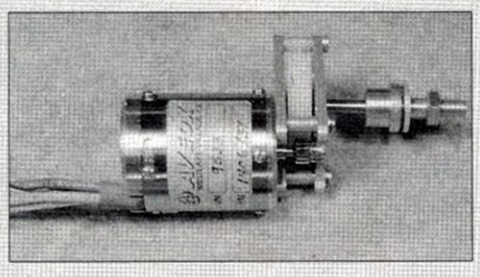
Brake: jumper selectable

Adjustments: separate range and starting point adjustments

Rotation direction: jumper selectable

Comments: shrink-wrap casing; large, unsupported capacitor protrudes from one side; less sensitive throttle response; not as good on loss-of-signal test; not linear near top of power range.

Aveox 1406/3Y



Dimensions: 1.5x1.9x1⅛ in. (dia. x length x shaft)

Weight: 8.7 oz. (with MEC SuperBox; supplied wires shortened to 6 in.)

Power rating: 600W

Wire/connectors: 11 in. (as supplied); Sermos; not installed.

List prices: $275 (1406/Y motor and F5MV control), $325 (1409/Y motor and F5MV control). Gearbox not included in either system.

Comments: cogs strongly; runs smoothly, once started; generous lengths of wire; adjustable timing.

motors. The instructions describe how to make the necessary adjustments. The Aveox instructions also describe how, just as with a brushed motor, a Y-wind motor's timing must be adjusted when you reverse the rotation. Initially, these instructions were not clear, but they have now been revised and are much easier to follow.

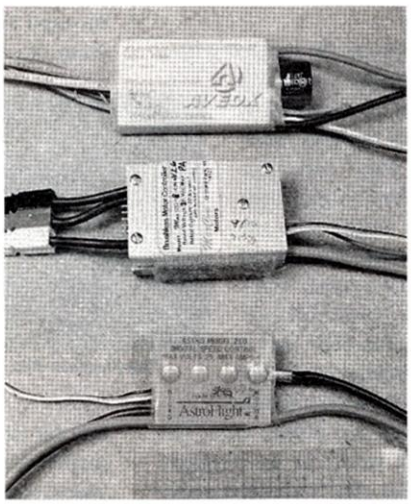
The MaxCim controller adjusts the motor timing electronically to suit the direction of rotation selected, so when reversing rotation, there's no need to physically adjust the motor.

For someone who is new to electrics and wants bigger, faster, or more aerobatic models than most first electrics offer, modelers should consider a brushless system as one they can start with and grow with.

TEST SETUP

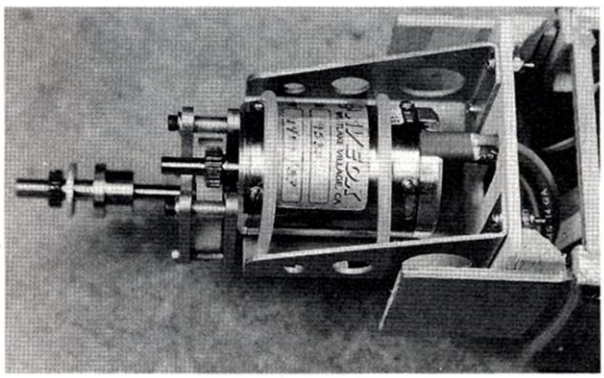
My main objective was to evaluate the "widely applicable" claim. I bench-tested the motors on seven and 16 cells, then I flew them in two very different models. To make it easier to compare the brushless motors with the conventional motors in these planes, I spent quite a bit of time selecting gear ratios; I also tried to match the brushless motor systems with the propellers I had been using on the two planes' conventional motors. This allowed me to bench-test the brushed motors from each plane and directly compare the results with those obtained from the brushless ones. This is the opposite of the usual practice of matching the prop to the power system and the plane.

• **7-cell plane**: an Idealair Elf 1-20E—a 50-inch-span, high-wing cabin plane with an under-cambered wing. It has most recently been flown with a Model Electronics Turbo 10 GT motor, running through a 4.3:1 ratio SuperBox to a Master Airscrew* 12x8 folding prop. A Flightec* SEC-SP microprocessor throttle with BEC and motor cutoff controls the power.



Comparing speed controls (top to bottom): Aveox brushless control, MaxCim brushless control, AstroFlight 210 brushed motor control.

• **16-cell plane**: a Stream Inc.* Schneider Sport 60 E—a low-wing sport/aerobatic plane that's powered with a geared standard-wind AstroFlight 25 cobalt motor turning a Master Airscrew 13x8 wooden electric prop. An Ace R/C* ST2635 modulates the power.



The Aveox 1409/3Y on a Stitzer MM-2 motor mount in the Schneider Sport.

I planned to fit several motors into both of these planes, so each had to be modified to handle several motor diameters. Stitzer Model Design's* clever aluminum Aero-Vee mounts solved the problem very neatly.

During every bench test, I took current, voltage and rpm readings at full throttle and at least one at a less than full-power rpm setting which was within the range of all the motors on that battery. To take the current and voltage readings, I used an Astro Flight 100 digital meter, wired between the battery and the speed control. I measured rpm with my trusty NorCal* Accutach I, which can read to the nearest 10rpm. I also put every brushless speed control through several tests to see how each would behave under several conditions, and how they compare with the brushed motor controls I've used.

When preparing for the tests, it took me a little fiddling to get the Aveox controller adjusted to my Airtronics FM radios, but it had been a while since I last adjusted an analog electronic speed control. It also took me a while to figure out just what to do with the MaxCim controller's red power-input wire. I eventually made up a short jumper with a Sermos Powerpole on each end, and I connected this to a length of wire that ended with a female Airtronics connector. I soldered a mating Airtronics connector to the red wire coming from the speed control. By doing this, I was able to use the receiver switch on the test stand or in the airplane to switch the power input to the controller. For 7-cell use, I put the jumper in the positive line between the battery and the rest of the power system. On 16 cells, I put it between the two 8-cell sub-packs, effectively center tapping the battery.

TEST RESULTS

On the bench, both brushless systems truly impressed me. They ran very smoothly and quietly, and it quickly became apparent that they were as good as the Turbo 10GT on seven cells. When I had the gear ratios right, they turned the 12x8 Master

Airscrew folding prop at slightly higher rpm at slightly lower currents. Then, just by changing gears and the battery pack, the same motors put quite a few more rpm into the same wooden 13x8 Master Airscrew electric prop than did the Astro 25G, but at a slightly higher current level. At partial throttle, the differences became really pronounced:

16 cells, 13x8 turning 6,000rpm

Motor	Input watts req'd.
Astro 25G	440
MaxCim Max 15-13D	395
Aveox 1406/3Y	393
Aveox 1409/3Y	383

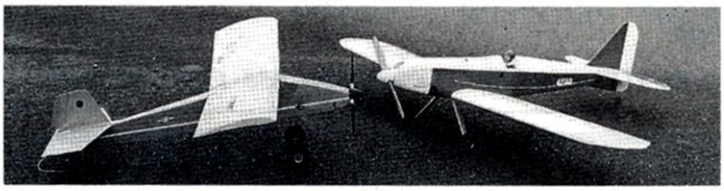
7 cells, Master Airscrew 12x8 folding prop turning 4,000rpm

Motor	Input watts req'd.
MEC Turbo 10GT	96
Aveox 1406/3Y	84
MaxCim Max 15-13D	78

For flying that isn't all at full power, this means longer flights.

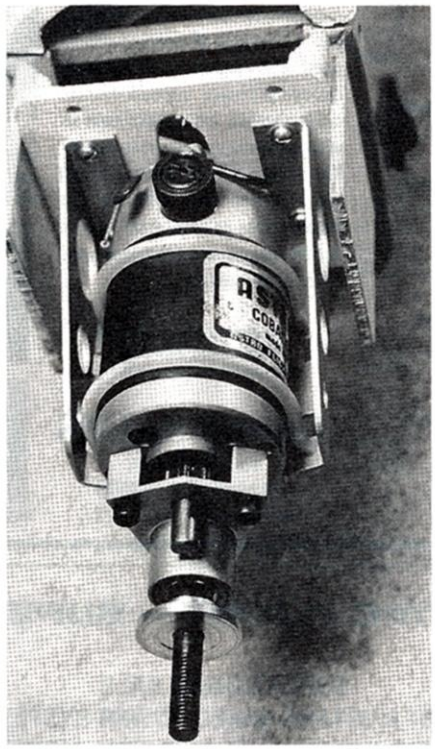
Especially at partial power, the brushless motors were markedly more efficient.

My flight tests confirmed these bench-test results. From the Elf, I got both livelier performance and longer flights, in spite of the higher weight of the brushless systems (2.9 ounces for the MaxCim, using the BEC mode of its control, and 3.5 ounces for the Aveox 1406, including a 180mAh receiver battery). For example, a typical flight might be a takeoff and climb to comfortable altitude, some loops, rolls and Immelmanns, a bit of cruising then shooting touch-and-go's till the battery ran down. With either brushless system, I got 1½ to 3 minutes *more* duration, and the MaxCim gave the longest flights. Aerobatic performance lasted longer into the charge as well. I ran the MaxCim Max 15-13D with a 3:1 gear ratio, and the Aveox 1406/3Y at 2.5:1.



The testbed airplanes: the Stream Schneider Sport 60-E (left) and the Idealair Elf 1-20 (right).

Geared 3:1, the Schneider on the Aveox 1409/3Y gave similar results with both noticeably stronger performance and slightly longer flights. With the MaxCim, I couldn't get a gear ratio high enough to hit my target of 35A maximum current draw at full power because a 13-tooth pinion was the smallest that would work with the 3/16-inch shaft. This pinion gave a ratio of 4.6:1 and a peak current draw of 41 amps at 7,000 prop rpm. With this setup, there was a tremendous performance improvement, and flight times were about the same as with the Astro 25G (it turns the same prop at 6,150rpm at 31 amps at full throttle). It seems I just couldn't resist using all that extra power! Going to 2.3:1 or so on the Aveox 1409/3Y gave similar performance. Running the 1406/3Y at about 4:1 did, too.



An AstroFlight geared 25 on a Stitzer MM-2 motor mount in the Schneider Sport.

The brushless installations in the Schneider were a little lighter than the Astro 25 and Ace throttle. Using the Aveox 1409/3Y saved 1.8 ounces, while the MaxCim saved 2.8 ounces (not using the BEC feature).

WHAT DOES IT ALL MEAN?

• First, I'm now convinced that a brushless system can be used in very wide range of applications. You really can use one brushless system in a plane that needs a 200W power system, then put the same system in 700W plane and get great performance there, too. Either brushless setup is comparable in cost to two good-quality brush motors and one good speed control.

• Second, in a 150W plane like my Elf, the added weight works against you. Though it has plenty of wing area and handled the extra weight, a small aerobatic ship might not tolerate the additional weight as well. If you replace a brushed motor of around 300 watts (between an Astro 15 and a 25) with a brushless one, you'll "break even"; if you replace a brushed motor of less than 300 watts with a brushless system, the weight penalty may be too high.

• Third, some of the brushless motors' other advantages can be significant; for instance, according to my range tests at the flying field, there really is much less RF interference from brushless power systems. Where I usually see a 25 percent or more reduction of range when running a motor at low throttle (when the speed control emits the most RF noise), with the brushless systems, the reduction of range was small (for the MaxCim) to none (the Aveox). In a problem installation—say, a complex scale ship—a brushless might be just the ticket. A brushless motor should last forever since the only wear point is bearings, and their life is measured in thousands of hours. Another advantage is they run much cooler.

Besides their higher initial cost and their need for a bigger speed control, are there other downsides to brushless motors? At the moment, you have to use a motor and speed control from the same supplier. They should be interchangeable, but one manufacturer voids the warranty if you make changes. The additional wiring required can make installation a little more difficult.

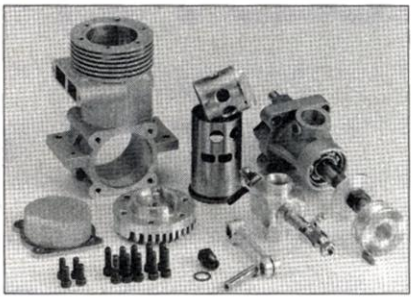
THE BOTTOM LINE

In the end, are brushless motors worth it for the rest of us—the Sunday fliers? I think the answer is: "For *some* of the rest of us." They certainly have a place in the hangars of those who fly a number of different models, especially the greater-than-7-cell types.

For someone who is new to electrics and wants bigger, faster, or more aerobatic models than most first electrics offer, modelers should consider a brushless system as one they can start with and grow with. Perhaps I just need to sell off some of my collection of motors and speed controls and pick up some of these new brushless units!

**Addresses are listed alphabetically in the Index of Manufacturers on page 128.*

by DAVE GIERKE



Disassembled and cleaned after break-in and dyno testing; there was no apparent wear.

WEBRA SILVERLINE .61

WHEN I FIRST opened the box, I knew I'd seen this engine before. But when? It was definitely an older design, and the contours of the crankcase indicated cross-flow scavenging. It had only one well-defined bypass passageway bulge (unlike modern Schnuerle-ported engines, which have several). Looking into the exhaust revealed the single compression ring and narrow baffle projecting from the crown of its flat-top piston. I was curious. How old was this design, and why had it survived so long in a rapidly changing and very competitive market? Some research was in order for the Webra* Silverline .61.

Webra Silverline .61 with expansion-chamber-type muffler. The engine is fitted with a TN-type carburetor.

Fortunately, I possess an almost complete set of *Model Airplane News* magazines extending back to the beginning—1929. These have proven to be a great historical reference for many model aviation topics, including engines, but I've always dreaded the time-consuming search required to find an engine review. I'd usually spend several hours looking—often futilely. As I carefully leaf through the aging pages of some old issue, I'm constantly distracted by articles about long-forgotten model designs and contest reports; often, I'm compelled to sit back and read these completely. Ah, the memories; frequently, I forget what I'm looking for!

Fred Souchek, a fellow member of the *Model Engine Collectors Association* (MECA), has recently compiled the "Model Airplane Engine Review Listing" for *Model Airplane News*. Approximately 500 engine reviews are organized according to manufacturer and cylinder displacement with year, month and page number provided for every engine reviewed. If you don't have back issues, the list isn't very useful; nevertheless, if you know someone who has a collection of *Model Airplane News*, copies of articles can easily be obtained; for $6 (including postage), the price is right. See Fred's address at the end of this article.

The December '67 issue of *Model Airplane News* informs me that our engine hasn't always been called the Silverline .61. In its day, the Webra .61 R/C was one of the elite engines used by many of the world's top R/C pattern fliers. Reviewed by Peter Chinn, the story behind the Webra comes alive. Peter always distinguishes his writing with a wealth of background material; he accomplishes this by establishing relationships with leading designers and manufacturers of miniature engines from around the world. This review is a perfect example.

According to Chinn, the Webra 10cc engine was originally designed in 1964 by West Germany's top profes-

SPECIFICATIONS

Cylinder displacement: 0.6081ci/9.97cc
Bore: 0.945 in./24mm
Stroke: 0.867 in./22mm
Bore/stroke: 1.09/1
Stroke/bore: 0.917/1
Conrod length: 1.529 in./38.84mm (center to center)
Conrod/stroke: 1.76/1
Combustion-chamber volume at TDC: 1.35cc
Compression ratio
— geometric: 8.39/1
— effective: 6.59/1
Carburetor bore: 0.312 in./7.92mm
Crankshaft thread size: 1/4-28mm
Weight (bare): 14.3 oz./444.5 gm
— with muffler: 16.8 oz./523 gm
Cylinder taper (TDC to BDC): none
Cylinder taper (BDC to sleeve): none

PERFORMANCE

Maximum torque: 120 oz.-in. at 6,900rpm
Maximum b.hp: 1.13 at 12,100rpm
B.hp/ci: 1.89
B.hp/lb.: 1.1
Oz.-in./ci: 197.3
Oz.-in./lb.: 114.3

NOISE LEVEL

Muffler/tuned pipe: 98dBA at 11,800rpm
Fuel: 15-percent nitro; 24-percent lube
Propeller: Top Flight 11x73/4
Sound meter: Radio Shack no. 33-2050
Meter setting: "A" scale; slow response
Distance from engine: 9 ft.

PORT AND INLET TIMING

Exhaust
— opens: 70° BBDC
— closes 70° ABDC
Total open: 140°

Transfer
— opens: 59° BBDC
— closes: 59° ABDC
Total open: 118°

Inlet (induction)
— opens: 35° ABDC
— closes: 50° ATDC
Total open: 195°

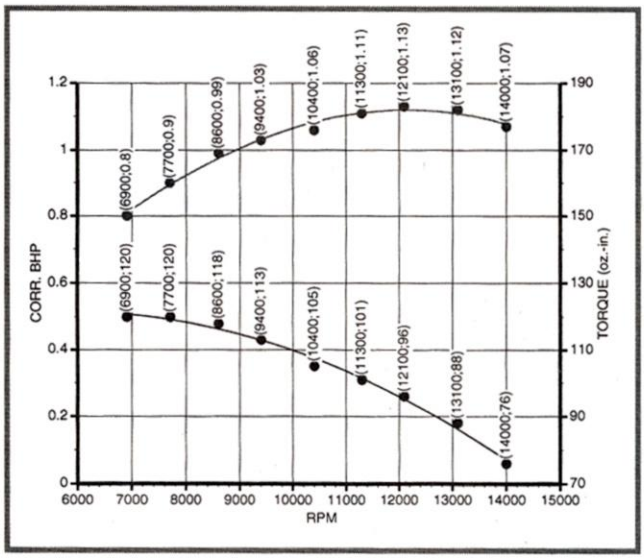
LIST PRICE: $159.95

Features: this glow-ignition, front-intake, side-exhaust, 6.5cc (.40ci) R/C engine has: split-crankcase construction, hemispherical combustion chamber, cross-flow-scavenged porting with piston/skirt ports, aluminum piston (with one compression ring), steel cylinder liner, twin-needle carburetor and twin ball bearings.

Hits
- Excellent value.
- Docile operation.
- Good low-rpm torque.
- Good idle.

Misses
- Would prefer oil holes in conrod ends instead of slits (see article).
- Quieter muffler would be welcome.

Comments: The lightweight Webra Silverline .61 is an excellent choice for novices and sport fliers. It's inexpensive and very user-friendly in terms of usable low-end power, throttle response and mixture adjustments. Follow the recommended procedures concerning break-in, lubrication and high-end needle settings during operation, and the Silverline should give long, dependable service.

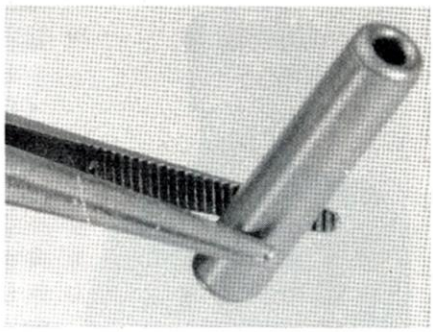


sional engine designer, Guenther Bodemann. Known as the .61 R/C, it was built by Fein und Modell Technik of West Berlin. It was intended to be an 8cc (.49ci) unit, when the designers suddenly realized that "multichannel" R/C models were becoming bigger and heavier and demanding larger engines. The 8cc project was promptly dropped, and a new 10cc design was pursued that reached the prototype stage by 1966.

RPM	TORQUE	CORR. BHP	BHP	CORR. FACTOR	DISTANCE
6,900	120	0.80	0.82	0.98	2.45
7,700	120	0.90	0.92	0.98	2.45
8,600	118	0.99	1.01	0.98	2.40
9,400	113	1.03	1.05	0.98	2.30
10,400	105	1.06	1.08	0.98	2.15
11,300	101	1.11	1.13	0.98	2.06
12,100	96	1.13	1.15	0.98	1.96
13,100	88	1.12	1.14	0.98	1.8
14,000	76	1.07	1.09	0.98	1.56

CONSTRUCTION

The Webra Silverline .61 is a side-exhaust, cross-flow-scavenged, front-rotary-shaft induction design with the following features: a crankshaft supported by twin ball bearings, an aluminum-alloy piston with a single compression ring, a steel cylinder liner, a forged connecting rod with bronze bushings and a hemispherical combustion chamber with a narrow squish band. Here are some of the particulars.



Hardened and ground 5mm wristpin with brass end pads.

• **Crankcase.** The pressure die-cast method is used to form the engine's basic aluminum-alloy structure. Since it was first introduced in '66, minor changes have been made to strengthen the unit; these include continuing the upper front housing and rear cover bosses as a single unit from front to rear. The case's exterior is bead-blasted to give it a more pleasing appearance.

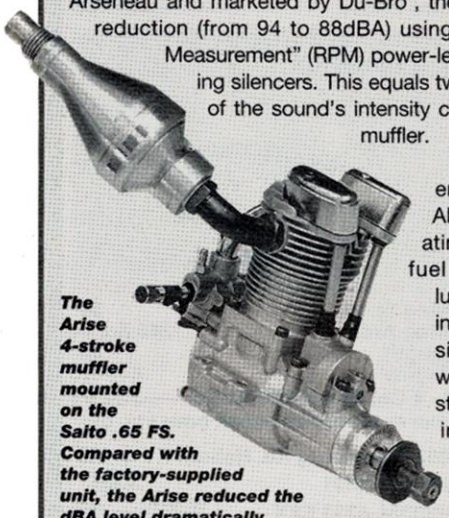
• **Front housing.** Die-cast and bead-blasted, the front housing follows the practice of the crankcase. The housing is aligned with the crankcase by positioning the rear ball bearing inside the horizontal bore of the crankcase. This technique was pioneered by K&B* on early prototype and production versions of their Series 66 .40s. Allen screws (3.5x1.2cm, coarse) are fully recessed in the thick flange of the front housing for attachment purposes to the crankcase. The ball bearings are 32mm o.d. (rear) and 22mm o.d. (front).

• **Rear cover.** This unit is also die-cast and bead-blasted. It, too, contains recessed 3.5x0.8cm (coarse) Allen machine screws. On

ARISE 4-STROKE MUFFLER

There's a new kid on the block! The Arise—an aftermarket muffler for 4-stroke engines—does a wonderful job of reducing the engine's sound intensity compared with the factory-supplied unit.

Designed and manufactured by noted Canadian inventor Michel Arseneau and marketed by Du-Bro*, the Arise managed a 6dBA reduction (from 94 to 88dBA) using the "Real Performance Measurement" (RPM) power-leveling system of comparing silencers. This equals two halvings or one quarter of the sound's intensity compared with the factory muffler.



The Arise 4-stroke muffler mounted on the Saito .65 FS. Compared with the factory-supplied unit, the Arise reduced the dBA level dramatically.

The Saito* .65 test engine was fitted with an APC 11x8 propeller, operating with 15-percent-nitro fuel containing 20-percent lubricant. The power-leveling mode of operation consists of fitting the engine with the factory muffler, starting the engine, opening the throttle to maximum, adjusting the primary needle valve for maximum rpm, throttling back to 12,100rpm and reading the dBA at 9 feet from the exhaust side of the engine, perpendicular to the crankshaft axis. Next, you remove the factory muffler and replace it with the Arise. Run through the same steps as with the stock muffler and compare power-leveled dBA readings.

The muffler weighs less than 56 grams (less than 2 ounces), including the adapter nipple and locking nut. The Arise is screwed onto the existing exhaust header pipe and is locked securely in place with a special jam-nut; all essential components for the engine of your choice are supplied with each muffler purchase. Through all of my test-running and flying, the muffler didn't once come loose from the header pipe—something that can't always be said of the factory-supplied units.

The RPM test model (Airtrax 60) fitted with the Saito and the Arise muffler sounded like an electric-powered model. On several occasions, some of the guys at the flying field thought the engine had quit! Early in the test program, I learned to look for the exhaust smoke rather than strain to hear it! Propeller noise was clearly the dominant noise factor for this test rig.

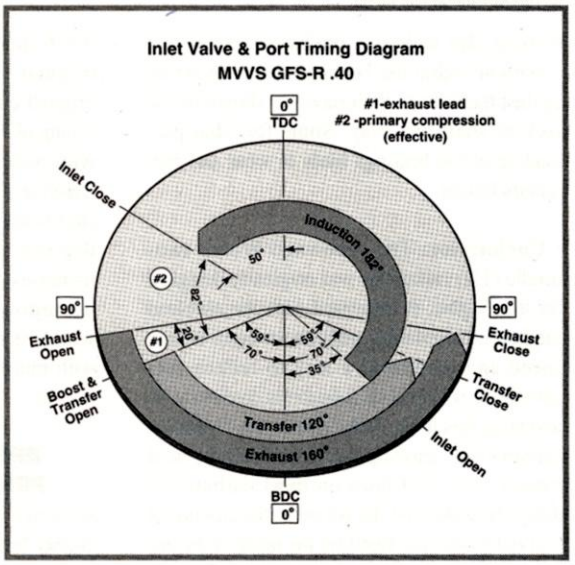
I recommend that radio manufacturers provide a simple telemetry down-link to an LED on the transmitter to indicate to the pilot when the propeller has stopped turning, or the engine has stopped running. The Arise-equipped engine is impossible to hear when another powered model is in the air nearby.

The prop drive is keyed to the crankshaft.

the front-facing portion of the rear cover, I noticed a circular scratch mark—something commonly produced by the crankpin contacting the rear cover. The rear cover came with *two* gaskets, so I was fairly certain that when assembled, there was contact with only one gasket. To check, I reassembled the front and rear housings with only one gasket and measured the crankpin-to-rear-cover clearance with a feeler gauge through the open cylinder bore in the case; it was only 0.0015 inch—too close to prevent contact, especially when using an electric starter. To correct the problem, the factory simply installed another 0.013-inch-thick gasket.

• **Cylinder head.** The pressure die-cast unit has a polished exterior that gives it a nice contrast to the other exterior components. The combustion-chamber side of the head contains a narrow squish band with a relatively steep angle (4.5 degrees). On the transfer-port side of the cylinder, the hemispherical combustion chamber has a cast slot running across it and the squish band; this supplies the required clearance for the piston's baffle. The baffle is a device used by most cross-flow-scavenged engines to deflect the incoming air/fuel charge toward the cylinder head and away from the exhaust port. The glow plug is centrally located at the top of the hemispherical chamber—the farthest distance from the piston. I discovered aluminum flashing blocking the air passage between several of the head fins. These were easily removed using a hobby knife (no. 11 blade) and a needle file.

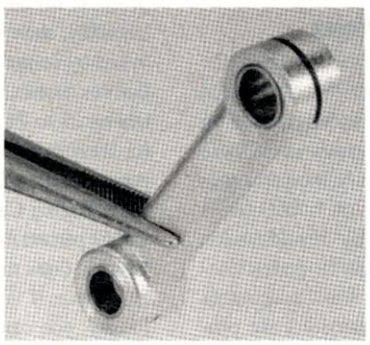
• **Cylinder sleeve.** The liner is made of steel that has been hardened and honed. Precision measurement with a telescoping gauge and an outside micrometer reveals that the bore maintains a uniform diameter from top to bottom—typical of most ringed engines. The original engine incorporated four exhaust ports and four transfer ports; the modern version has the same number of exhaust ports but only three transfers; these bridges (vertical webs) prevent the compression ring from bulging out into the port opening.



• **Piston.** The piston seems to be the same today as it was in the '60s. With a total piston-to-sleeve clearance of 0.0035 inch, an aluminum alloy such as no. 4032 was probably used; containing between 12 and 14 percent silicon, the expansion would be less than an alloy's without silicon, e.g., no. 2024. Piston weight, including the compression ring, is a moderate 10.9 grams. As mentioned previously, the piston has a flat crown and a straight baffle. There are two piston-skirt bypass ports (0.297 inch diameter), which are aligned with similar orifices in the cylinder sleeve at BDC. The legendary Dooling .61 racing engine of the '40s and '50s transferred all its crankcase mixture through piston ports; the Silverline .61 passes only a portion through the piston because the lower end of its bypass channel is open to the crankcase. Some designers believe that this flow-through feature helps to cool the piston, while others suggest that the practice leads to increased piston deformation and wear. A single compression ring is fitted 0.050 inch from the crown of the piston.

Piston and cylinder. Note the piston ports and their cylinder-sleeve counterparts. Also note the single compression ring.

• **Connecting rod and wristpin.** The original configuration had a machined-aluminum-alloy connecting rod with a Duerrkopp needle roller-bearing assembly at the wristpin end. A hardened (Rockwell 60) and ground, 5mm-diameter steel wristpin was push-fit into the piston bosses where it was held by wire circlips to prevent it from moving. This beautiful arrangement is rarely seen today because of its cost. Also, at higher speeds, the additional reciprocating mass could result in destructive inertial forces that increase with the square of the shaft speed. For example, if shaft speed doubles, the inertia quadruples ($2^2 = 4$).



The crankpin end of the connecting rod. Note the long lubrication slits..

Today's Webra is fitted with a forged aluminum-alloy connecting rod with bronze bushings at each end. For some reason, Webra engineers have retained the dated technique of sawing lubrication slits at the ends of the rod, though most manufacturers long ago switched to drilling holes; it's believed that slits rupture the delicate oil film and cause wear because of metal-to-metal contact.

The same 5mm-diameter wristpin has been retained as a free-floating unit; measurements with a small hole gauge and outside micrometer indicate that with the piston-boss holes, the wristpin is operating with 0.0005 inch clearance—quite a bit. To prevent the cylinder wall from being scored, the ends of the wristpin have been fitted with soft brass inserts.

• **Crankshaft.** The most noticeable feature of the crank is its pressed-in crankpin. With a diameter of 0.236 inch (6mm), the crankpin is inserted into a crank web that's almost 5/16 inch thick. Shaft counterbalancing is achieved by using milled flanks on either side of the crankpin. The axial induction hole has a bore diameter of 0.435 inch (11mm). The prop driver is held on the shaft by a 0.095-inch (2.5mm) woodruff key. Crankshaft nose threads are ¼-28. Following K&B's long-established practice, the crank is pressed into the inner races of the two ball bearings to form a rigid assembly within the front

housing; this technique produces a pre-loaded condition within the bearings (balls forced up against the sides of their races) as shown by the lack of shaft-end play. Some feel that pre-loading of the bearings leads to wear and premature failure.

• **Carburetor.** The renowned Webra two-needle (TN) carburetor was originally designed for this engine. It dispensed with the air-bleed method of regulating mixture strength at low speed and employed a way to reduce fuel admission. The late Hi Johnson is credited with inventing this in the early '60s on his Dynamax carburetor by moving the barrel laterally as it rotates, just as it does on most carburetors today. However, on the Johnson, the amount of fuel reduction was fixed by the taper of its single needle valve; it could only be altered by substituting another needle with a different taper. The Webra system allowed a full range of adjustment by means of a secondary needle that "traveled" with the lateral movement of the barrel. It worked the same then as it does on modern engines: by entering the fixed jet tube at the center of the choke bore when the throttle rotates toward the closed position, thus reducing the amount of fuel being admitted.

• **Muffler.** The original engine was equipped with a centrally pivoted restricter plate mounted on the exhaust stack; this was coupled to the carburetor throttle arm with a short link of rigid wire. Intended to improve idling characteristics by increasing cylinder backpressure, it did little for noise reduction. The modern engine still retains the cast center punch mark on the exhaust stack reinforcement web indicating where this plate was fastened with a machine screw. Today's engine is fitted with an expansion-chamber-style muffler that doesn't have internal baffles; unfortunately, it's comparable to the ineffective unit provided 30 years ago!

SPECIFICATIONS

With a cylinder displacement of 10cc, the Silverline .61 incorporates the often-used 24mm bore and 22mm stroke to produce an over-square configuration with a stroke/bore ratio of .917:1. The middle-of-the-pack connecting-rod-to-stroke ratio of 1.76:1 yields an average conrod angularity at mid-stroke. Although this produces moderate piston side-loads against the cylinder wall, acceptable overall engine-height dimensions are preserved—a common design compromise for the era.

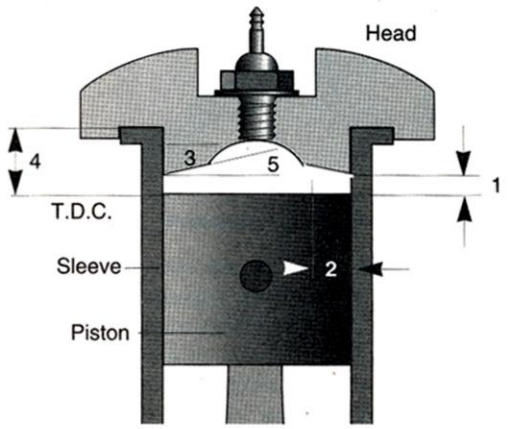
The effective compression ratio (measured from exhaust-port closure rather than from BDC) is a mild 6.59:1. Small by modern standards, the 0.312 inch diameter of the carburetor choke seems large compared with the tiny 0.276 inch diameter from the original engine of 1966. The original engine had an exhaust timing of 126 degrees compared with today's 140 degrees; the transfer-port timing has also increased from 104 to 118 degrees; the change slightly increases the maximum brake horsepower and the rpm at which it occurs. The engine with muffler weighs only 16.8 ounces.

BREAK-IN AND PERFORMANCE

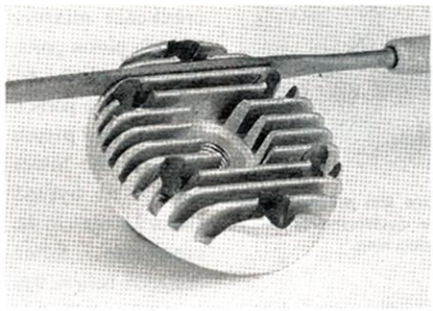
As usual, the engine was thoroughly broken in *on the bench.* As I've mentioned in previous columns, the break in of ringed, aluminum-alloy pistons in hardened-steel cylinders requires "cool and oily" operation for relatively short periods; the repeated heat-cycling process wears the soft cast-iron ring to the hard cylinder. Prolonged running without frequent cooling intervals does little for the break-in process; instead, with the engine 4-cycling smoothly, short bursts of about 2 minutes followed by complete cooling seem to work best. For this engine, I recommend a fuel blend containing 22 to 24 percent lubricant (by volume) for break in and flying applications. I prefer 12 percent Klotz KL-200 synthetic and 12 percent Klotz Racing Castor; 15 percent nitromethane and 61 percent methyl alcohol make up the rest. Because I mix my fuel, these percentages aren't a problem; if this combination isn't available locally, you can either add lubricant to your standard fuel, or order it custom-blended by a reputable manufacturer such as Red Max.

I ran the Silverline .61 for an hour and a half; I spent the last 30 minutes leaning the needle valve to peak rpm for a few moments, then richening to cool. When it finally maintained an *almost* peaked rpm setting, I was satisfied we were ready for the dynamometer and torque tests.

Head & combustion chamber dimensions



1. Head clearance	.0.023 in.
2. Squish-band width	.0.100 in.
3. Plug depth	.0.182 in.
4. Deck clearance	.0.208 in.
5. Squish-band angle	.4½°
% squish-band area	.37.8%
% combustion-chamber area	.62.2%



A needle file was required to remove aluminum-alloy flashing from between the fins on the cylinder head.

From the performance curves, you can see that the engine produces very good, low-rpm torque—120 oz.-in. at 6,900rpm; because of this, the Silverline .61 handles relatively large propellers (14x5 and 14x6) with ease. When loaded down, overheating wasn't a problem. I attribute this to the low effective compression ratio and mild port timing. The peak brake horsepower topped out at 1.13; between 10,400 and 14,000rpm, the b.hp remains within 6 percent of the peak, which occurs at 12,100rpm. Here are some generic propeller sizes that are suited to this wide horsepower band: 10x8, 11x6, 11x7, 11x8, 12x5, 12x6 and 13x5.

The engine-muffler combination recorded a not-so-quiet 98dBA when peaked to 11,800rpm on a Top Flite 11x7.75 propeller. The Radio Shack no. 33-2050 sound meter was set at the standard distance of 9 feet from the exhaust side of the engine, perpendicular to the axial centerline of the crankshaft.

After the dyno tests had been completed, the engine displayed a pleasing "snap" when flipped past TDC. Next, I checked for crankcase compression leaks. Blowby at the exhaust—between the case and sleeve—will often manifest itself as power loss and/or unreliable idling characteristics. By placing a few drops of low-viscosity oil at that juncture (in the exhaust stack) and turning the propeller at a moderate speed (with the glow plug removed), the descending piston pressurizes the crankcase. Careful observation revealed no bubbles and confirmed the integrity of the

seal and primary (crankcase) compression. The Webra idled at a pleasing 2,400rpm.

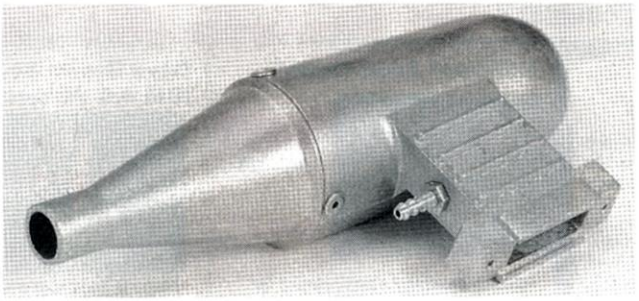
CONCLUSIONS

The relatively large clearance between the wristpin and the piston bosses (0.0005 inch) signals the importance of using generous percentages of lubrication in the fuel blend. Although it's always bad to operate an engine lean, it's particularly hazardous with the Silverline .61. A lean needle-valve setting will guarantee a hot and dry wristpin/piston-boss hole assembly; already a relatively loose fit, it won't take long to pound the holes oblong.

This engine is also a good candidate for an effective aftermarket muffler, such as the Arise 2-stroke unit sold by Du-Bro Products. Initial tests showed a reduction from 98 to 89dBA at 11,800rpm, with the Top Flite 11x7.75 propeller.

The instructions that accompanied the Silverline .61 were minimal. It would be more reassuring—especially to beginners—if a complete set of instructions was included with every engine. Here's what I'd like to see:

- an exploded view of the engine, keyed to a parts list;



The expansion-chamber-type muffler supplied with the Silverline .61 lacked internal baffling. Notice the pressure fitting and pop rivets used to join the fore and aft sections.

- warranty, repair policies, and parts ordering information;
- detailed description of the engine's features;
- starting and running details;
- carburetor operation and adjustment;
- detailed break-in procedures;
- fuel blends, propellers and glow-plug recommendations;
- safety precautions.

The Webra Silverline .61 isn't a fearsome, fire-breathing dragon; on the contrary, I was impressed by its gentle manners. My notes remind me that the Silverline .61 was a joy to operate. It responded to needle valve and throttle-carburetor changes smoothly and predictably—a trait not always found with its modern high-compression counterparts. After investigating it from every conceivable angle, I can understand why this Webra has been selling well for 30 years; it's reliable, smooth and relaxing to operate.

At the risk of being accused of promoting my book, "2-Stroke Glow Engines for R/C Aircraft," I want to recommend the following chapters to those who seek more in-depth information about this month's discussion: Engine Break-In—Chapter 17; Effects of Conrod-to-Stroke Ratio—Chapter 7; Significance of Stroke-to-Bore Ratio—Chapter 6; Checking for Wear—Chapter 22. Also, you can contact Fred L. Souchek at 1304 Cedar, Concordia, KS 66901; (913)-243-3329.

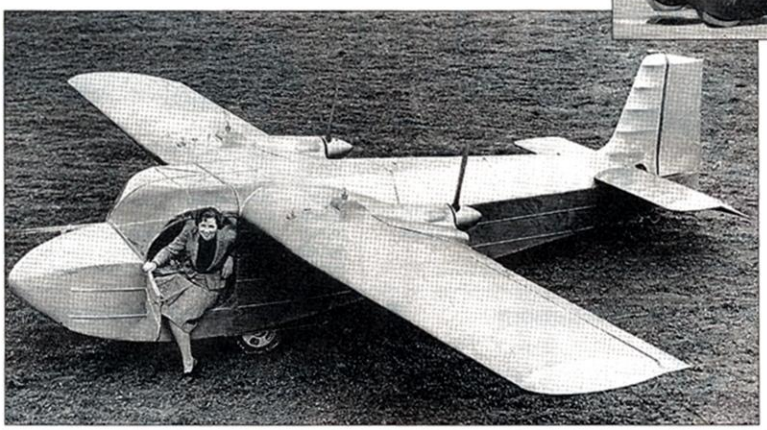
**Addresses are listed alphabetically in the Index of Manufacturers on page 128.*

Name THAT PLANE

CAN YOU IDENTIFY THIS AIRCRAFT?

If you can, send your answer to *Model Airplane News*, **Name That Plane Contest** (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897-3035.

CONGRATULATIONS to John T. Deden of Missouri City, TX, for correctly identifying the May '96 mystery plane. The Boeing Model 100A was a Boeing 100—a civilian version of the P-12B single-seat fighter that was rebuilt and highly modified by the late Howard Hughes.



The redesign included a taller vertical fin, a revised horizontal tail, a full NACA cowl and large wheel pants. A subsequent owner outfitted the plane for smoke, and this plane was also flown by the 1927 Dole Derby winner, Col. Art Goebel. This little super-sport bipe carried a 750hp engine that gave it a cruising speed of 220mph. The 30-foot-span aircraft was constructed of welded alloyed-steel tubes, spruce, mahogany and duralumin and was covered with fabric. Thanks to all who wrote in; good luck next month!

The winner will be drawn four weeks following publication from correct answers received (on a postcard delivered by U.S. Mail), and will receive a free one-year subscription to *Model Airplane News*. If already a subscriber, the winner will receive a free one-year extension of his subscription.

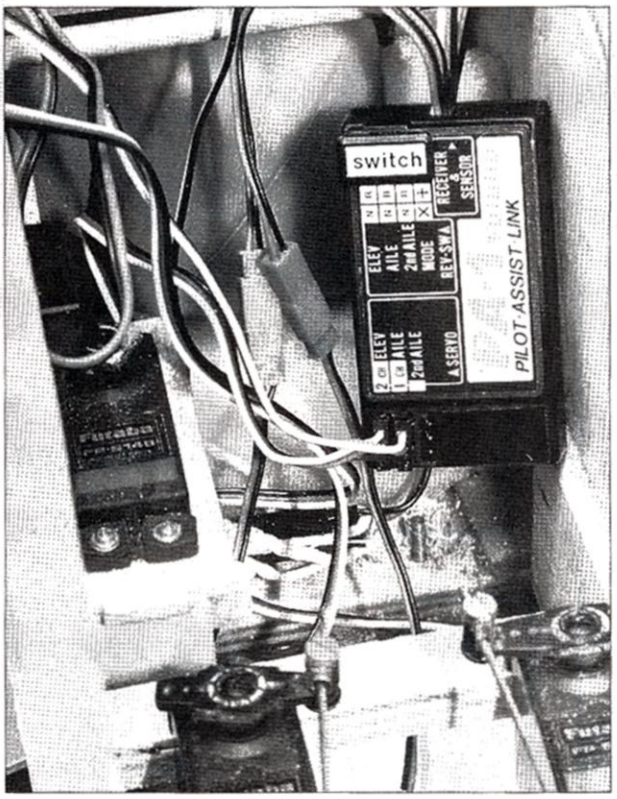
MODEL AIRPLANE NEWS

PRODUCT REVIEW

Attitude adjustment for the flier

Futaba's Pilot Assist Link PA-1

by ROGER POST JR.



The PA-1's amp is about the size of a receiver and contains plug inputs for aileron, elevator and a second aileron channel. Six wires exit the amp; two go to the sensor, and the elevator, aileron, second aileron channel and auxiliary channel each get one wire. To access the reverse switches, remove the part that has "switch" printed on it.

IT SEEMS that modelers, no matter which level they have achieved, get quite a bit of assistance these days. From self-righting airplanes and engines that run virtually trouble-free to computer radios that simplify setup adjustments and flying, just about every facet of our hobby has been enhanced.

Futaba* has just made flying easier with their new Pilot Assist Link (PA-1). It will level the airplane and make any type of model extremely stable.

HOW IT WORKS

The PA-1 has four light sensors: front, back, right and left. These sensors detect a difference in the brightness of the light that shines on them during flight, and this difference is converted into an output signal. This signal is sent to the amplifier (amp), which processes the information and sends the correct control input to the aileron and elevator servos. The plane will not, however, return fully to a level attitude unless the pilot lets go of the sticks. The PA-1 runs off the 4.8V Ni-Cd that powers the receiver and draws 50mA.

Futaba says that you'll need a digital proportional R/C set with a volume control channel and fail-safe function. The volume channel is a flap or auxiliary knob that will allow you to control the PA-1's sensitivity. Turning the flap knob clockwise increases sensitivity, and counterclockwise decreases it. If you reverse the flap channel, the opposite is true. The PA-1 can also be used with 6-channel radios that have a three-position flap switch: flaps up would be zero sensitivity; the flap switch in the middle position would be 50 percent; and the flap switch in the lower position would be 100 percent.

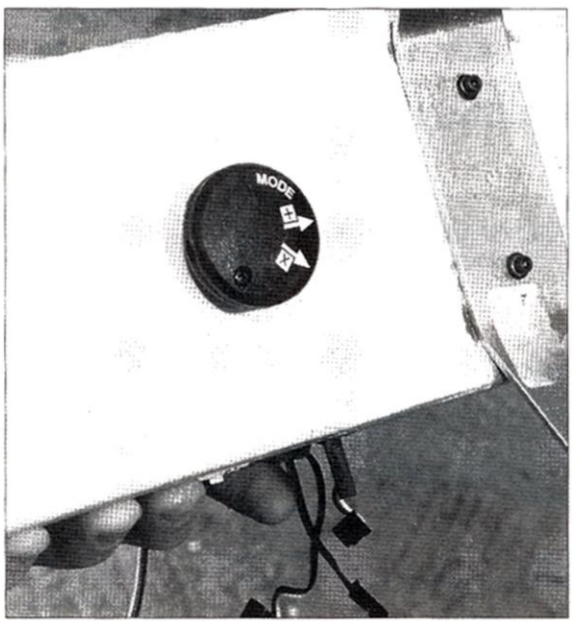
The instructions include several caution boxes; read the entire instruction sheet before you attempt to install and operate it.

INSTALLATION

In the center of the bottom of my Hobby Lobby* Telemaster 70, right under the CG, I drilled a 10mm hole and installed the PA-1's sensor unit with the plus sign facing forward. Make sure there are no obstructions (muffler, gear, etc.) to the sensors; an obstructed sensor could send a false reading to the amp and cause errant control. If there's an obstruction, line up the sensors at a 45-degree angle to the longitudinal axis of the fuselage. You can set this angle by turning the sensor so that the X faces forward. If your sensor had to be mounted on the 45-degree offset, switch the plus/X switch inside the amp to the X side. If the plus faces forward, make sure the plus decal on the sensor is lined up with the sensor eye. The eye, not the plus mark, should face directly forward. Connect the sensor to the amp part of the unit with the two small connector plugs provided.

Next, plug the elevator and aileron servo leads into the marked receptacles on the amp. Then plug the amp's red auxiliary wire into channel 6 or 7 of the receiver, and plug the elevator and aileron-1 amp wires into their respective receiver channels. If you use two aileron servos, there are an extra receptacle and wire (marked aileron 2) for that application. For the test, Dave Baron, Russ Pribanic and I used Futaba's new FP-T8UAF transmitter and receiver.

The instructions have clear drawings, but some of the wording could use clarification, especially the part about the



I mounted the sensor on the bottom of the plane, right under the center of gravity. Since there were no obstructions in the front of the plane, I mounted the sensor with the plus sign facing forward.

SPECIFICATIONS

Name: Pilot Assist Link PA-1—a leveling device for R/C planes

Manufacturer: Futaba Corp. of America

Dimensions: amp—64x35x20mm; sensor—35x36mm (dia.)

Weight: amp—41gm; sensor—22gm

Current drain: 50mA maximum

Power req'd: 4.8V Ni-Cd battery that's shared with the receiver

Part no.: 013000

List price: $179.95

Features: round sensor with four light-detecting "eyes"; signal-processing amp about the size of a small receiver; all connecting cables; instruction booklet.

Comments: the PA-1 is a good tool for beginners, especially those who confuse right and left, but an expert will have to set up the PA-1 and test it *before* any beginner attempts to fly the plane.

Hits

- Easy to install.
- Ideal for beginners because it levels the plane.
- Allows the plane to recover from any unusual attitude.
- Helps stabilize difficult-to-fly scale models.

Misses

- The instructions should be clearer.
- Beginners would have difficulty understanding setup.

hookup of the auxiliary plug. You'll have to read between the lines and interpret what has to be done. A beginner should seek help to install this unit.

THE TESTS

To check the sensors' operation, do two tests. The first is an indoor test and requires that you shine a light on each of the four sensors and check the control responses. If you receive an incorrect response, you can reverse the control direction by moving the tiny reversing switch inside the processing amp. When you raise the sensitivity indoors, you might see some control deflection; there's no need to be alarmed because the unevenness of the room light causes this.

For the second test, take the model outside and tilt it in the four directions of the sensor eyes. Observe the control-surface deflections, and re-check the direction in which they travel. As you turn the sensitivity up with the volume knob, you'll notice that the surfaces have greater deflection. In the air, the higher the sensitivity, the faster the plane will recover from an unusual attitude.

DOES IT WORK?

And how!! We took the plane to the field and sent it up to a comfortable altitude with zero sensitivity dialed in. We trimmed it for hands-off level flight and then put it into unusual attitudes. With the sensitivity on zero, we let go of the sticks, and the plane slowly righted itself. With the sensitivity on 100 percent, we let go of the sticks, and the plane righted itself quickly.

We found the best sensitivity adjustment to be 50 percent. This setting allowed the plane to recover from any attitude but still let the pilot fly it comfortably. When we were flying, we felt the PA-1 working, but it didn't fight the pilot control inputs. But flying the plane inverted was not as easy as it had been before.

Of all of the recoveries from the crazy attitudes we tried, recovery from the flat spin was the most amazing. I put the Telemaster into a flat spin, and it recovered faster than it would have if I had done it manually. Incredible!

IS THE PA-1 FOR YOU?

Sure, because fliers of any level can use it. For the instructor, it will be a useful teaching tool; all you have to do is condition the beginner to let go of the sticks. As a flier's abilities progress, the sensitivity can be decreased, and he can be taught how to fly out of an unusual attitude. The scale designer/pilot who has an unstable aircraft will find the PA-1 a great help in stabilizing a recalcitrant plane. Also, it's ideal for twin-engine aircraft because it will help keep the wings level in an engine-out situation.

For the pilot who wants to fly on a windy day, the PA-1 is perfect because it will help level the wings after a gust has hit the plane. I also used it on a Telemaster 40 that was rigged for aero-towing gliders. It really helped stabilize the tow-plane, especially when the glider went into an unusual attitude.

Give it a try, and I'm sure you'll find uses for it besides those I've mentioned.

**Addresses are listed alphabetically in the Index of Manufacturers on page 128.*

LATEST PRODUCT RELEASES

K&A MODELS

Dago-Red Racer

This high-performance slope glider can be converted to ½A power. The kit includes an epoxy/fiberglass fuselage, cut wooden parts, foam-core wings, hardware, plans and instructions. Specifications: span—30.5 inches; wing area—188.72 square inches; airfoil—modified E374; ready-to-fly weight—12.5 to 13 ounces; radio required—mini 2-channel.

K&A Models Unlimited, 9300 Yvonne Marie Dr. NW, Albuquerque, NM 87114; (505) 890-7549; fax (505) 890-7532.

GREAT PLANES

Easy Touch™ Hand Sander

Made of sturdy, lightweight aluminum, this new 5.5-inch-long sander features a contoured handle to reduce hand stress. Adhesive-backed sandpaper sheets in 80, 150 and 220 grit fit the sander perfectly. (Eleven- and 22-inch-long sanders are also available.)

Part nos.—GPM6169 (5.5-inch sander), GPM6189 (assorted sandpaper); **prices**—$3.99, $2.49.

Great Planes Model Distributors, 2904 Research Rd., Champaign, IL 61826-9021; (217) 398-6300; fax (217) 398-0008.

KYOSHO

Cobalt Aircraft Motors

Made of high-grade samarium cobalt magnets, these motors deliver peak performance even under severe temperature and current conditions. A balanced armature assembly provides high rpm with minimum vibration and wear. Windings are epoxy-impregnated for superior heat conduction and electrical insulation. The motors also feature adjustable timing, a compact aluminum endbell, low-profile alloy brush holders and caps and large air inlets.

Part nos.—KYOG2601 (.05 motor), KYOG2602 (FAI motor); **prices**—$109.99, $129.99.

Kyosho; distributed by Great Planes Model Distributors, 2904 Research Rd., Champaign, IL 61826-9021; (217) 398-6300; fax (217) 398-0008.

AIRDROME

Customized Wood and Plastic Parts

Airdrome plans service now offers machine-cut balsa and ply formers, ribs, etc., for its line of contest-proven, scale, electric R/C models. Designed by Steven Stratt, Airdrome plans are well-researched and accurately detailed. Send $4 to Airdrome for a list of available plans and wooden parts. Vacuum-formed cowls, hatches, fillets, etc., for Airdrome plans are available from EPP Inc. at (800) 304-3774.

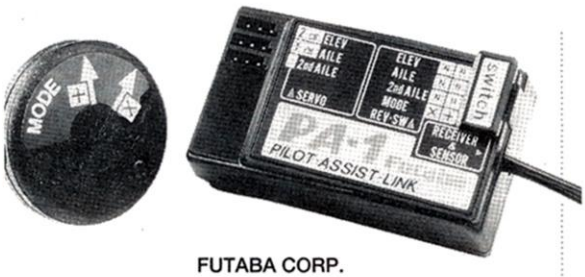
Airdrome, P.O. Box 1425, FDR Stn., New York, NY 10150; (212) 421-1440.

WAHOO INTL.

Solarez

This paste of polyester resin, chopped-strand fiberglass and UV-activated catalyst will harden in about 45 seconds when exposed to sunlight. It is available in a variety of formulas and can be used at the field to make quick structural repairs to fiberglass, wood, metal and plastic.

Wahoo Intl., 2605-D Oceanside Blvd., Oceanside, CA; (619) 967-7873; fax (619) 967-0146.



FUTABA CORP.

Pilot Assist Link

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Part no.—BB-10; **price**—$105.95.

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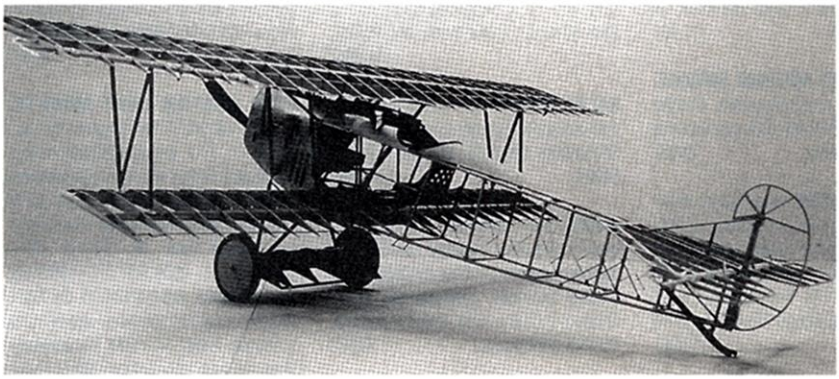

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Part nos.—HCAP5100, HCAP5105 (deluxe); **prices**—$177.99, $211.99.

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WANTED: ignition model engines 1930s to 1950s, especially Elf, Baby Cyclone, Brown Jr., Ohlsson Custom and Gold Seal. Also model racecars, any parts, spark plugs, etc; Woody Bartelt, 3706 North 33rd, Galesburg, MI 49053; (616) 665-9693, or (800) 982-5464. [10/96]

CASH FOR ENGINES: ignition, glow, diesel–all types; any condition; sale list, too! Estates my specialty! Send SASE for list. Bob Boumstein, 10970 Marcy Plaza, Omaha, NE 68154; (402) 334-0122. [8/96]

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EVENTS

MODEL HOBBIES SHOW AND SALE: July 13, 9 a.m. to 4 p.m., Bellflower Masonic Hall, 9813 Beach Street, Bellflower, California. Admission—$4, sale table—$40. Caryl Sitter, 13674 Bennington Court, Fontana; (909) 899-4561. [8/96]

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Hitec/RCD Inc.,
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(619) 258-4940;
fax (619) 449-1002.

Hobby Lobby Intl.,
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Brentwood, TN 37027;
(615) 373-1444;
fax (615) 377-6948.

Horizon Hobby Distributors,
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JMP (Jet Model Products),
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K&B Mfg.,
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Lanier RC,
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GA 30566; (404) 532-6401;
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LDM Industries Inc.,
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(716) 662-9324;
fax (716) 662-5651.

Master Airscrew;
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Micro Fasteners,
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NJ 08822; (908) 806-4050;
(908) 788-2607.

Mid Columbia Engineering (MCE),
801 Pine St., Seattle, WA
98101; (206) 621-1988;
fax (206) 382-9293.

Model Electronics Corp.,
6500 6th Ave. NW,
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Moki;
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Nor-Cal Aero,
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Pacer Technology,
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Cucamonga, CA 91730.

Precision Eagle;
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470-B Scots Dr., Naperville, IL
60563; (708) 416-6940.

Proctor Enterprises,
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Aurora, OR 97002;
(503) 678-1300;
fax (503) 678-1342.

Robart Mfg.,
P.O. Box 1247,
625 N. 12th St.,
St. Charles, IL 60174.

Saito;
distributed by
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Sermos R/C Snap Connectors Inc.,
Cedar Corners Station,
Box 16787,
Stamford, CT 06905.

Stitzer Model Design,
113 William St.,
Centre Hall, PA 16828;
(814) 364-9530.

Stream RC Models,
P.O. Box 1113,
Newport News, VA 23601-0113;
(804) 591-0720.

SuperTigre;
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TAGS (Total Aero Graphic Services),
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Tom Dixon,
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Marietta, GA 30066.

Top Flite;
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Tru-Turn,
P.O. Box 836,
South Houston, TX 77587;
(713) 943-1867.

Turbomin,
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Miami FL 33173;
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Webra;
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(see address above).

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Zap Glue,
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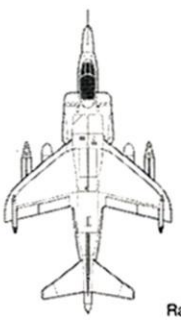
Zenoah;
distributed by Indy R/C, 10620
N. College Ave., Indianapolis, IN
46280; (800) 338-4639.



ADVERTISER INDEX

FLYING TURBINES

Terry Nitsch's Hot Flash is a turbine-powered showplane with performance that just won't quit! A JPX from Bob Violett Models provides the "whoosh"!

At the '96 Top Gun Scale Invitational, six turbine-powered jets made successful flights, with three in competition.

BVM* owner Bob Violett is the U.S. distributor of the French-made JPX turbines, which powered Garland Hamilton's Lockheed DT-33B Sea Star in Expert and Jerry Caudle's P-80 Shooting Star in Team Scale. Terry Nitsch's halftime showplane—the Hot Flash—and Bob Violett's practice P-80—the Kansas Tornado—also had JPX powerplants

The Team Scale entry of Reinol Gonzalez and Albert Araujo, who flew a modified JMP* T-33, was powered by the Swedish-made Turbomin* turbine. A Turbomin also powered a non-competing Grumman F9F Panther built from Nick Ziroli plans.

A non-competing F-86 built and flown by FiberClassics* Andreas Gietz of Germany was powered by the Japanese-made Sophia Precision J-450.

GROUND SUPPORT

All turbines, regardless of the brand, have the same requirements for starting. They need ignition (from a spark plug), fuel and compressed air to spin up the turbine blades.

The JPX turbines (the T-250 in Terry Nitsch's Hot Flash, the T-260 in Garland Hamilton's DT-33 and Jerry Caudle's P-80) are fueled with liquid propane, and this requires a steel cylinder for the fuel tank. Liquid propane is self-pressurizing and eliminates the need for a fuel pump.

A modified JMP T-33 becomes a turbine-powered P-80. Reinol Gonzalez and Albert Araujo import the Turbomin turbine.

To start the JPX, attach the external ignition wires, the turbine pressure gauge and temperature probe, then spool up the turbine with compressed air, hit the ignition switch, and add the fuel. When you hear the ignition rumble, set the TX throttle to idle rpm.

The Turbomin turbine is fueled with straight kerosene (or jet-A fuel) contained in a fuel bladder (plastic bag). To start the Turbomin, first connect the external ignition system to the engine, then attach the external fuel to a T-fitting in the fuel system with a quick-disconnect fitting. Air from a Scuba tank is also attached. The Turbomin comes with a starting box that has the fuel and ignition switches, a pressure gauge and an air-supply connection. With all the connections made, first switch on the ignition. You can hear the spark inside the combustion chamber. Turn on the fuel pump, and wait for the rumble as the fuel is ignited (it sounds like a Coleman Caterpillar space heater starting up). Open the air valve, and spin up the turbine. Then simply disconnect the ignition wires and the external fuel line, and set the TX throttle setting to idle speed.

The Sophia Precision J-450 is started in the same manner as the JPX, but it can be run on jet fuel, kerosene, or white gas. When the J-450 first came out, it had a complicated fuel system that relied on a nitrogen cartridge to pressurize the fuel system. Gietz modified the fuel system and added a fuel pump, thus eliminating the need for compressed nitrogen gas.

READY TO TAXI

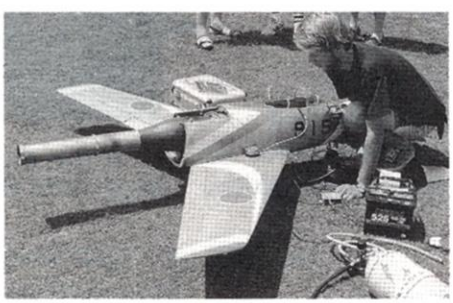
The biggest adjustment that pilots have to make is to be much further ahead mentally when they fly their turbine jets. Turbines, like their full-size counterparts, require 3 to 5 seconds to transition from idle to full thrust (about 110,000rpm), but they also need that time to go from max to idle rpm.

For takeoff, it's nice to have brakes so you can spool up to full thrust and then start your takeoff run. During landing, the gear and flaps come down early on the downwind leg, and the throttle must be brought back. This is so that when you're on final and committed to a touchdown, your engine rpm is where you want it to be. A missed landing requires that same time lag for full power and a go-around. It didn't appear to be a big deal for turbine pilots at Top Gun, but it does take some getting used to. An interesting note is that, even at idle, turbines produce about 1 to 2 pounds of thrust, so it's important to have a model with flaps and perhaps speed brakes to dirty the airframe up for consistent landings.

If you fancy yourself a true jet jock, then a turbine just might be in your future. Turbines aren't in the prototype stage anymore; these powerplants are on the shelves waiting for you to pick them up.

—Gerry Yarrish

A modified Ziroli F9F Panther with a Turbomin turbine comes in for a landing at Top Gun.



Andreas Gietz of FiberClassics demonstrates his J-450 powered F-86. The whole tail section of the F-86 can be removed to service the turbine.